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Vol. 33. Index to Advertisers and Classified Index Following Reading Matter. No. 18.

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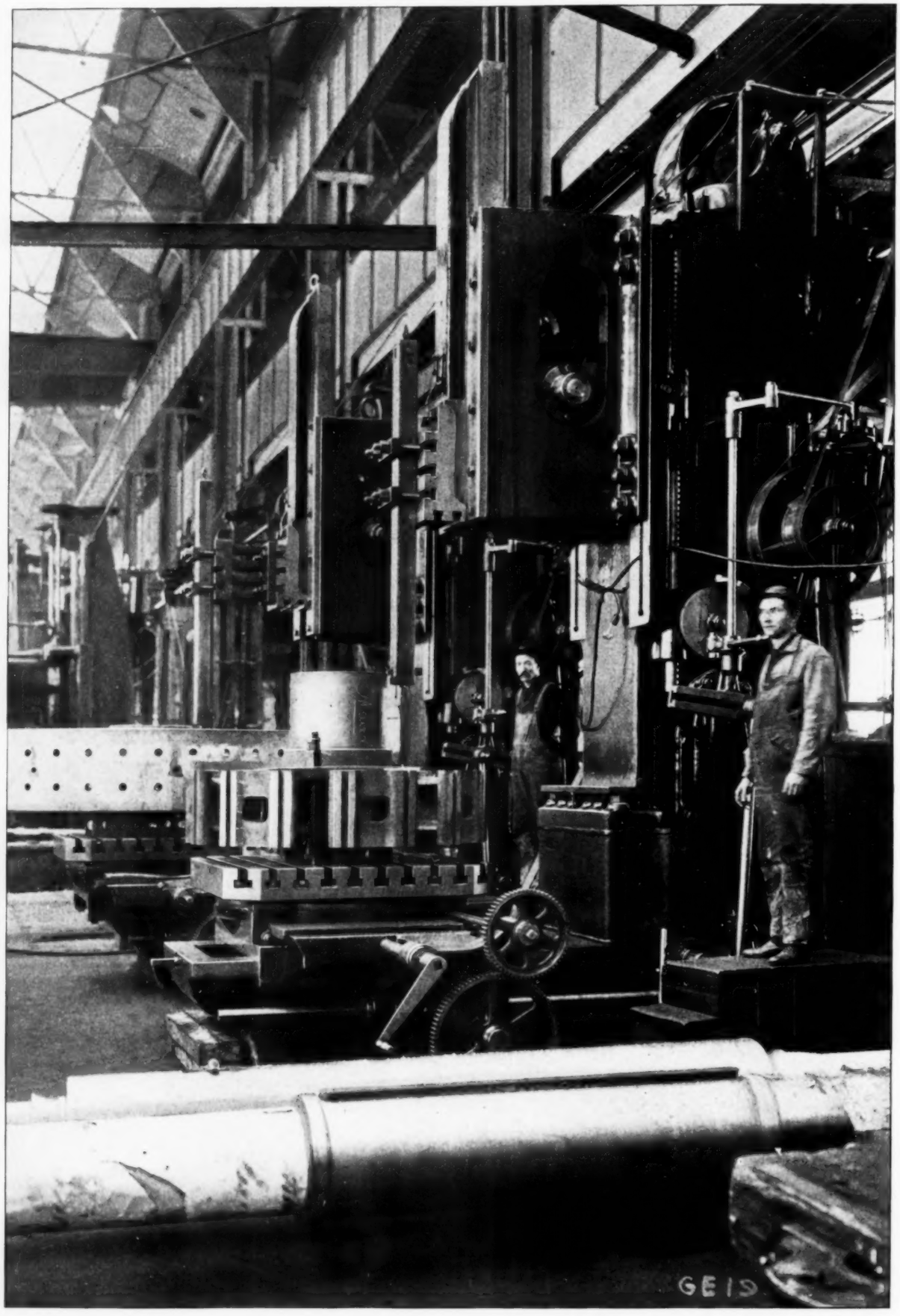


**Two 60-Inch Bement Geared Slotting Machines in the Machine Shops of the General Electric Co.**

First slotter is machining revolving field armature. Second slotter is machining revolving field.

# Handling the Census Returns for the Whole United States

*The Machines Which Make and Count the Cards That Tell All*

## Special Correspondence

On Friday, April 15, 65,000 enumerators began the work of taking the Thirteenth Decennial Census of the United States. This work consists in obtaining the answers to a maximum of 32 questions regarding every man, woman and child in the whole country. Heretofore the work of compiling and tabulating census statistics has been both long and arduous, necessitating the employment of thousands of clerks for several years. This year the work is being done with special machines which have been built by the Sloan & Chace Manufacturing Company, Limited, of Newark, N. J., under contract with the Bureau of the Census, Department of Commerce and Labor.

The statistics regarding each individual are recorded on a pasteboard card which is divided into "fields," each field containing certain printed figures, abbreviations of words, etc., which serve as symbols to correspond with the various personal details which have been collected and reported by the enumerator. The enumerator's report is then transferred to a card by means of a special machine which punches small, round holes in the card at the places showing the figures and symbols which correspond with the facts reported by the enumerator.

FIG. 1. POWER CENSUS CARD PUNCHING MACHINE WITH CARD JUST LEAVING PUNCHES

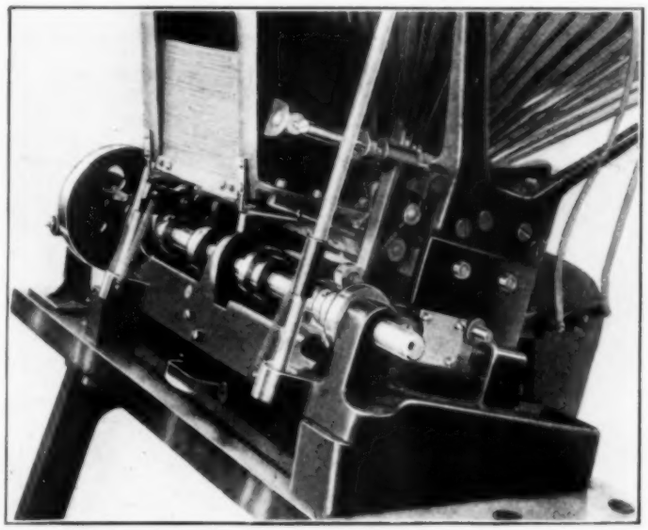

FIG. 2. REAR VIEW SHOWING CARDS

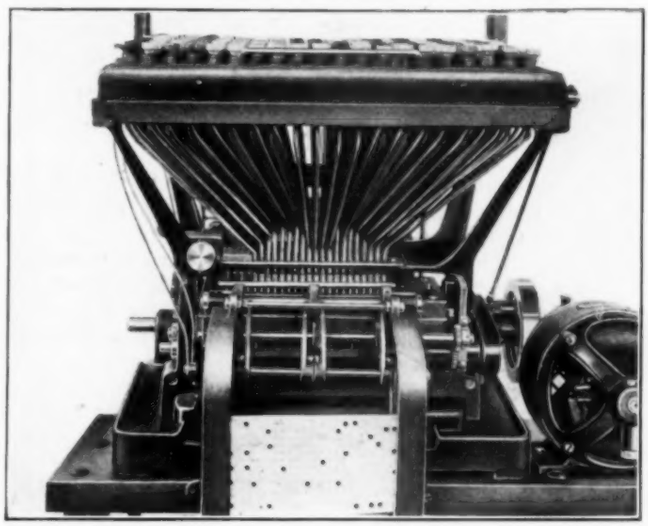

FIG. 3. THE PUNCHES AND CARDS PASSING THROUGH

### PUNCHED CARDS MAKE BEST RECORDS

This method of recording a fact by means of a hole punched in a card is more legible and permanent than any written or printed record could be. Moreover, these holes make it possible to tabulate the statistics semi-automatically in a second machine at the rate of 4000 cards per hour. As one hundred of these tabulating machines are in operation, it is possible to compile the statistics covering 3,200,000 people in one working day of eight hours. And there will be no mistakes in this work, if the holes have been correctly punched in the cards.

As it seems inevitable that this method of making and tabulating records will be soon extensively used by all large business concerns, a general description of these machines should be of interest to all readers of the AMERICAN MACHINIST.

The card-punching machine is built on

the order of a typewriter, and has a keyboard with 240 keys (machines with a greater number of keys can be built for commercial use, if necessary). Each key, when depressed, puts in operation a punch which punches out the symbol corresponding with the fact reported by the enumerator. The keys are inscribed with characters similar to those appearing on the printed card, and the "fields," or groups of facts, are shown by keys of different colors.

### Punches All Holes at Once

The machine shown in Fig. 1 in its operation differs from a typewriter in a most important respect. As is well known, in operating the typewriter, each time a key is depressed a character is printed and, if a mistake is made, the character must be crossed out or corrected, involving loss of time and disfiguration of copy. The punching machine obviates this, as the operator, instead of punching one hole at a time, can depress into position for subsequent punching as many keys as are necessary to record the required facts.

Each key is independent of all the others and can be released at will. Before pressing the bar which throws the clutch connecting the motor with the punching mechanism, the operator can look over the depressed keys, comparing them with the enumerator's report, and if a key has been erroneously depressed, it can be released and the error rectified. This work of correction is assisted by having, as stated above, different colors for the keys in each field, or division of the card.

The card is placed on a die plate which has holes corresponding to the printed locations on the card, and the depression of the bar brings the die and card against the ends of the punches which have been set up by the operator when depressing the necessary keys. These punches then pass through the card into the die, making clean, round holes in the card, and all of these holes are made simultaneously. The card is then immediately withdrawn and dropped into either the Male or Female compartment of a receiving magazine. In this way the preliminary sorting by sex is accomplished. Fig. 1 shows a female card in the lower track while Fig. 3 shows a male card. This sorting is controlled by the fingers shown over the card in Fig. 1, these being thrown in either position by the rods seen at the side in Fig. 2 which connect to the male and female keys on the board above.

At the same time the card is ejected, a new card is fed from a hopper and is in position for punching. Simultaneously with this operation, the schedule sheet containing the enumerator's report on one hundred persons, which is held in a holder, has been advanced so as to bring another line within the vision of the operator, after which the operation of punching is again proceeded with.

### The Punching Machine

One of the sheets sent in by the census enumerators is put into the punching machine at the top until the top line appears between the metal plates. The operator then reads the statistics, presses the correct keys, and after comparing them, presses the bar in front which throws in the motor and all holes are punched at one operation.

The motor drives the rear shaft shown in Fig. 2 by a worm gear and the cams shown at the side, force the die, carrying the card, up against the punches.

There are 240 keys, each being fastened to the upper end of one of the punch bars shown in Fig. 3 and each bar has a special "set" or offset to bring it to just the right position. When a key is pressed, the bar is held down to the punching position and acts as a stop for the punch itself which is directly below the bar. In this way only the punches beneath the bars which are pressed down are operative in punching the card.

### Punches 400 Cards an Hour

A punching machine was used in connection with the census of 1900, but it punched a hole each time the operator copied a fact. If an error was made, the card had to be taken out and thrown away. As the operator's efficiency (so called) was based largely upon the number of cards punched in a day, the old method tempted the clerk to let the error stand. With the old-style machine, an operator could average about 135 cards per hour, as compared with an expected average of about 400 per hour from the new machine.

Simultaneously with the punching on each card of the individual data from the schedule, what is known as a gang-punch is also operated. This is a series of punches which engage the four left-hand columns on the card. By suitable combinations of these punches, which are readily adjustable, the gang-punch can be made to give a different combination of holes for each enumeration district. The gang-punch enables immediate identification to be made on the tabulating machines of any card which may have been misplaced, or is not in its proper position, or district. While the operator is punching a card, the machine also, by means of the gang-punch, is automatically applying a mark, or designation, to the card, which shows that it is one of

Fig. 5. Covers Removed to Show Details

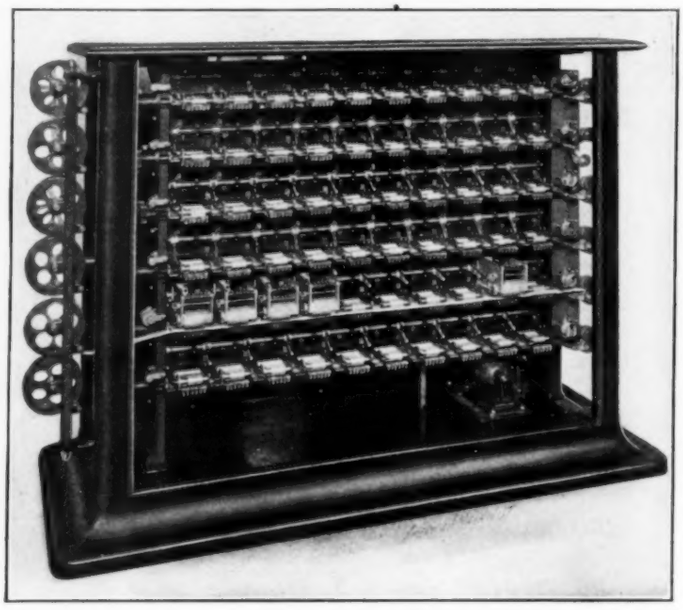

Fig. 6. Mechanism at the Back

the total number representing all of the population in a particular census area, whether city, county or State.

### The Tabulating Machine

After the cards have been punched, they are ready for verification. This process is accomplished in the tabulating machine shown in Fig. 4, and all cards which will be used subsequently for compiling the statistics of the census will be submitted to this verification, which consists, primarily, in the elimination of all inconsistent cards.

### Catching Inconsistencies

For example, the machine is so connected that all cards which are recorded "WF" (wife) in the relationship field must be punched "M" (married) in the conjugal condition field. All persons punched "N" (native) must be punched "EN" (English) in the language field. Also, all cards indicating that a male person has a gainful occupation usually followed by females, or punched as being for females with occupations usually followed by males, will be rejected. These rejections are accomplished by so wiring the tabulating machine, using relays to control the different circuits, that, if a card which should be rejected is inserted in the machine, the indicating bell does not ring. All "good" cards, or those which contain no inconsistencies (apparent or real) will operate this indicating bell; the operator places these cards in a box adapted to receive them. Those which have been rejected by the machine are set aside and are immediately compared with the schedule report, to ascertain whether they are in accordance with the facts reported, or whether the errors are the result of carelessness on the part of the punching-machine operator. In many cases, it is found that the facts are not correctly stated in the schedule report, and in such instances the supervisor of the district from which the schedule was received is called upon to give a corrected statement.

At the same time the cards are being passed through the tabulating machine for verification, a count is being made of the total number of cards in each district, which count is afterward used as a check on the subsequent tabulations.

After the cards are properly verified they are ready to be sorted into such groups, or classes, as may be necessary to give the statistical data desired.

### Recording the Statistics

The tabulation of the cards is accomplished on the same type of machine as was used for verification, but, instead of the connections being made through relays only, they are made direct to counters. The machine is inclosed in a heavy cabinet, from the front of which extends a movable arm or lever, attached to the outer extremity of which is a "pin box" containing a small spring-actuated pin for each possible hole in the cards.

The operator feeds the cards by hand, one at a time, upon a plate directly under the pin box, shown at *A*, Fig. 5. This plate has holes that come under those in the card. Beneath each hole is a mercury cup. After placing a card in the receiver, the operator touches a button which connects the lever with the driving mechanism. This automatically brings the pin box down upon the card. The electrically charged pins pass through the holes into the mercury cups, contact is established, and the current causes one or more dials, or counters, to register. In other words, each pin and its mercury cup form terminals of a current passing through an electromagnet controlling a counter for each item of data required. The pins which reach the unpunched surface of the card are pushed back into the box so that no contact is possible.

The tabulating process is completed by an automatic recording and printing system, somewhat on the stock ticker plan, connected with each dial. This is shown in Fig. 6, which is the rear of the machine and has one tap and five counters in place (There are spaces for 60 counters, and all of them can be used, if necessary). When the operator wishes to make a reading, or to ascertain a total, or series of totals, an electric button is touched and the details are automatically printed on ribbons of paper, after which the counters return to zero.

When the transfer of information to the cards has been completed, the schedules are filed away. The clerks handling the cards cannot tell, from anything on them, the names or addresses of the individuals for whom the cards stand, so that, in the tabulation and subsequent statistical processes, the personal element is lost and a card is known only by its own number.

### The Designers of the Machines

The tabulating machine is the result of the combined efforts of several experts employed in the Census Bureau.

The punching machine is the invention of James Powers, a mechanical expert in the employ of the Bureau, and the model punching machine was built under Governmental direction. But Mr. Powers has been allowed United States letters patent, and is preparing to place the machine on the commercial market.

Mr. Powers is also the inventor of a tabulating and sorting machine which is wholly automatic and purely mechanical in operation. It differs from the Census machine in that it has a computing mechanism for commercial work. It should be understood that the requirements of the Census Bureau are met with their present machine, which tabulates units only.

The Government's contract with the Sloan & Chace Manufacturing Company provided for 300 punching machines and 100 tabulating machines.

Fig. 4. Front View of Tabulating Machine

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The smallest engine in the world, says the *Sibley Journal*, is named "Tiny Tim." The cylinder is of steel, with a bore of 0.03 inch and a stroke of 1/32 inch. It makes 6000 revolutions per minute, developing 1/489,000 of one horsepower. At "full load" at this speed, the eye can detect no motion of the parts, but it produces a hum like that of a mosquito.

Seventeen parts complete the engine, the "net weight" of which is four grains. One hundred such engines would weigh one ounce. The bed plate is of gold, with inserted, hardened and ground, self-oiling bearings.

# Feed Mechanism for Drilling Machine

*By Herman R. Isler*

In this feed mechanism the following features are embodied in the design; first, the feed box is made as a unit and may be manufactured in a special department equipped for this purpose; second, all feed changes are made by one knob which is conveniently located to the operator and the feed index is very simple and direct reading, no "slow-fast-in-out-right-left" to puzzle the operator; third, the feed box is neat in appearance, cheap to make and easy to assemble.

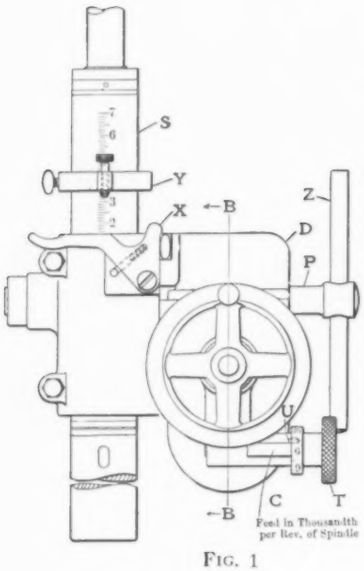



FIG. 1

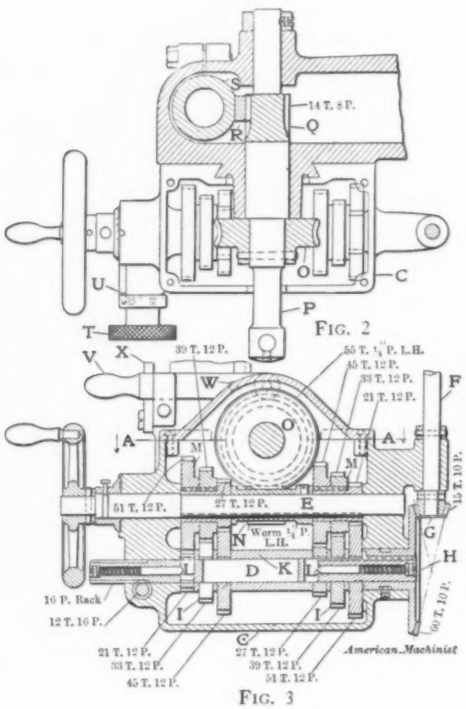



FIG. 2

FIG. 3

FEED MECHANISM FOR DRILL PRESS

Fig. 1 shows a front elevation of the drill-press head and feed mechanism, Fig. 2, a horizontal section on line *A A* and Fig. 3 a vertical section through the feed box at *B B*.

The feed box is located on the side of the head; it is made in two parts for convenience in assembling, a lower part *C*, and an upper one *D*, fastened together by 4 screws. Box *C* forms bearings for the two horizontal feed shafts *D* and *E* and also for the lower end of the vertical feed rod *F*; it is closed on all sides except at the top and may be used as an oil reservoir. The feed drive is taken from the spindle and transmitted either by belt or gearing to the feed rod *F*, then through bevel gears *G* and *H* to feed shaft *D* on which are loosely mounted two sets of change gears *I I*, each of these change gears is provided with 3 keyways. Between the gears are hardened steel washers *J J* and spacing collar *K*. The inner edges of the washers *J J* and collar *K* are chamfered on both sides to facilitate the passing of sliding keys *L L* which also have beveled edges.

These sliding keys are forced out into the keyseats of the gears by springs and beveled plungers in both ends of shaft *D*. They are so spaced that one of them is withdrawn by one of the washers *J* or collar *K* while the other one engages a change gear. It will be noticed that this type of sliding key does not weaken the shaft as much as the usual construction where a long key is pivoted on one end and a spring placed under the other end to push the key out. With this double sliding key arrangement shaft *D* has to slide only about one-half of the distance otherwise required by a single key. Having the change gears arranged in two series and placed as shown in Fig. 3 makes a neat symmetrical arrangement. Gears *I I* mesh with corresponding gears *M M* which are keyed to shaft *E*. Between the two cones of gears *M M* is worm *N*, this drives worm wheel *O* on shaft *P* and pinion *Q* thereon engages with rack *R* on spindle quill *S*.

The changing of the feed is accomplished by turning knob *T*; on the inner end of the shaft on which the knob is fastened is a pinion, this meshes with the circular rack teeth on shaft *D*. Knob *T* also forms a dial on which the feed in thousandths of an inch per revolution of spindle is stamped. The following feeds are obtained with the gearing shown: 0.006— 0.009— 0.013— 0.018— 0.025 and 0.036 inch. There is a stop pin *U* in knob *T* which strikes against a projection on the head to prevent the knob from being turned around too far.

In this design the well known gravity feed trip is used and therefore box *C* provided with a vertical dovetailed slide fitting over a mating dovetailed seat on the side of the head. Hand lever *V*, pivoting on pin *W*, is connected to the upper part *D* of the feed box. The feed is engaged by pressing down on lever *V*; this raises the feed box and brings worm *N* into mesh with worm wheel *O*. Trigger *X* catches lever *V* and prevents the feed box from dropping. Stop collar *Y* on spindle quill *S* automatically releases trigger *X* when the depth, for which the feed was set, is reached and allows box *C* to drop and to disconnect worm *N* with worm wheel *O*. The spindle is returned to its normal position by turning lever *Z* on quick return shaft *F*. Shaft *E* is provided with a dial graduated to read in thousandths of an inch; this will be appreciated by the operator when counterboring to an exact depth has to be done. When knob *T* is turned until any short line on the dial coincides with the zero line the power feed is disconnected and the operator enabled to use the hand feed.

## Summer Courses for Engineers and Artisans at the University of Wisconsin

The tenth annual session of the Summer Schools for Engineers and Artisans of the University of Wisconsin opens June 27, continuing for six weeks.

Advanced courses are offered in direct and alternating currents, hydraulics, machine design, descriptive geometry, applied mechanics, shopwork, steam and gas engineering and surveying. Elementary courses for artisans, and those not having preparation for the advanced work, are offered in applied electricity, engines and boilers, fuels and lubricants, mechanical drawing, machine design, materials of construction, shopwork and surveying.

The teaching staff is taken from the regular instructional force, and all laboratory equipment of the engineering college is available for students. For bulletin or further information, address F. E. Turneaure, Dean, College of Engineering, Madison, Wisconsin.

# Annealing High Speed Steel in One Hour

*By C. U. Scott*

It is very seldom that I propose radical changes, and in making these proposals I want the readers to bear with me until they have made a fair test of the methods that greatly reduce the time of annealing all classes of work. The first change that I want to take up and advocate, as a permanent and general method, is the annealing of high-speed steel. It can be accomplished in one hour's time. In fact, on small pieces, say 1 inch in diameter, the time will not exceed 40 minutes for annealing.

Some three years ago, in a letter to the AMERICAN MACHINIST, I stated that I was able to anneal high-speed steel in 30 minutes. I have tried this method for the last three years, and now use it exclusively, and am ready to recommend it to others.

The annealing process in vogue in most shops consists in packing the steel in a cast-iron box, or pipe, in iron shavings, or some other material with a high melting point; then heating the whole to the required temperature, which is about 1300 degrees Fahrenheit, and keeping it at this point until thoroughly and evenly heated throughout. This means from 4 to 5 hours for heating up to the desired temperature and allowing the material to cool for about 14 hours, or 18 hours in all. There are very few able to heat steel packed in a box and know precisely what temperature the piece is at that is being annealed. Thus it will be seen that pack annealing, unless properly executed, will be a poor job, from the fact that the operator is not able to see the heat that is produced on the pieces or work that is being annealed.

### SIMPLICITY OF PROCESS

My process is very simple, and the heat can always be observed. First, we heat the steel slowly until it reaches 1292 degrees, a somber red, then shut off the fire and allow the heat to drop back to a red visible in the dark, or until cool, if so desired. In fact, this operation is precisely the same as if we were water annealing ordinary carbon steel, it being immaterial whether the piece is heated to a little more than 1292 degrees or allowed to cool entirely before the second heating. After the piece has cooled to the desired heat, then place it in the furnace and heat to about 1292 degrees and hold it at this heat for 30 minutes. Then remove it from the fire and allow it to cool in the air.

While the piece will become soft if cooled in the furnace, I much prefer removing it and thus prevent prolonging the heat longer than is necessary. I have tried this method on all classes of work, such work as steel in the unannealed state as it came from the mill, and on all kinds of tools, reamers, taps, milling cutters, etc. I not only find that it produces a greater degree of softness than when annealed by being packed, but that it is also the most convenient and reliable way of annealing.

### DETAILS

In order that the method may be fully understood, let us say we have a milling cutter 4 inches in diameter, with a 5-inch face. We would take this milling cutter, place it in a furnace that was running at a low heat, not more than 752 degrees, as heat must be applied very slowly to a cutter of this size of high-speed steel when hard. We would then raise the temperature to 1292 degrees, or thereabout, and then take it from the furnace and allow it to cool in the air. As soon as the piece had become black, we would return it to the furnace and again heat up to 1292 degrees and hold it at this temperature for 30 minutes. We would then take the cutter from the fire and allow it to cool in the air. As soon as it becomes cool, it will be found thoroughly annealed, in fact, much more thoroughly than with any other method that I have ever tried.

While I have warned others not to place hardened high-speed steel in a hot furnace, yet I have taken milling cutters, form tools, etc., and after heating them on a hot iron until they were blue, have plunged them in a lead bath at a temperature of 1300 degrees, and had no bad results from cracking or checking. We have everything that could be desired for the proper annealing of any grade of steel, yet high-speed steel annealed in the regular way is found to be harder than the 30-minute process, as we call it, when tested by the Brinnell method. We have annealed every tool or piece of high-speed steel in this way during the last three years, and have our first tool to have any complaint from, either from breakage or from being hard due to its treatment.

### COOLING IN LEAD BATH

The other change that I am ready to recommend is the cooling of high-speed steel in a lead bath which is at a heat of 1000 degrees or more. My first experience in using this method was in 1903 while in the employ of the Crane Company, of Chicago. I made a great many tests, using a variety of baths for cooling, and found lead to be superior to all the baths tried.

During the last six years I have been hardening tools for cutting hard and tough material and as a great many representatives of steel makers suggest a more drastic bath than fish oil for the cooling of high-speed steel, I followed this line when requested to. I began a series of experiments in hardening tools in a lead bath and after trying this method for several years, have no hesitancy in saying that a piece of high-speed steel heated to the proper heat for quenching and quenched in a lead bath at 1000 degrees temperature or more, will be superior to any other method of cooling.

### OBJECTIONS OVERCOME

One serious objection to this method has been from the fact that lead would stick to the steel. This objection has been overcome by covering the lead cooling bath with one-half inch of potassium cyanide. While passing the tool through the cyanide, into the lead, sufficient cyanide adheres to the cutter to form a coating which prevents lead from adhering to the tool or cutter. We often hear of high-speed steel being cooled in water, kerosene and paraffin, the tools giving entirely satisfactory results. If we consider the following facts, we can see that we do not get all that there is in the steel when using drastic baths for cooling. Ordinary high-speed steels begin to harden at about 1832 degrees heat, and continue to become harder until 2012 degrees, a dull orange, is reached. After this heat is reached and up to 2372 degrees the steel becomes softer when quenched than if quenched between 1800 and 2200 degrees.

In order to make this plain, let us say we hardened a tool at 1832 degrees, one at 2012 degrees, another at 2200 degrees, and another at 2372 degrees. The tools hardened at 1832 and 2012 degrees would be harder than the tools hardened at 2200 and 2372 degrees, provided a drastic cooling bath is used. This can be observed in using the tools. Say we have a reamer or tap; these tools, if they have not been heated to the high heat all over, will break more readily in the part of the tool which has had the lower heat in the hardening.

### DRASTIC COOLING

The one reason why so many have succeeded when using a more drastic cooling bath than fish oil, is from the fact that they have not had the tool at its best hardening heat, thereby they have gotten the tool hard enough to do the work from drastic cooling, whereas, if the same tool was heated to 2372 degrees and cooled at a high heat, it would be a softer tool and contain more red hardness and do better work than if hardened at the lower heat. In the drastic bath, one tool has become hard because it was cooled suddenly down to 400 degrees, the other has become hard because it was cooled suddenly down to 1000 degrees. To have taken both tools from

the bath at 1000 degrees heat would mean that the tool with the low heat would be worthless, while the high-heated tool would be the best that can be produced.

A great many are inclined to think that sufficient heat can be gotten on high-speed steel in the forge fire. I am willing to admit this, and at the same time say that very few tools heated in a forge fire are at their highest point of efficiency for this reason: If we heat high-speed steel to its proper hardening heat and then reharden this tool as is customary with lathe tools, etc., we utterly destroy the grain of the steel, giving it a coarse grain instead of having the silky appearance which is justly due this steel when properly heated and quenched. If the lathe tool had the extreme heat at the first hardening, it would have a poor grain at the second hardening.

I want to say, also, that when high-speed steel is quenched in a drastic bath, such as water, kerosene or paraffin oil, it simply possesses red hardness, but is void of all strength and has a grain that is but little better than overheated carbon steel. However, this does not hold true with all high-speed steels (in relation to the grain) if quenched in water. Some will have a flaky appearance like galvanized iron, but it all shows the effect of such drastic cooling, and its qualities as far as the tool is concerned, are greatly impaired.

The above would mean that to reharden a tool after it has reached the high and proper hardening heat, it would destroy it. This can be entirely overcome by annealing previous to the second hardening and again after the piece is hardened the second time without annealing. It will then do considerable work, but its efficiency will in no wise equal a tool having but one proper heat.

### Selecting Furnace

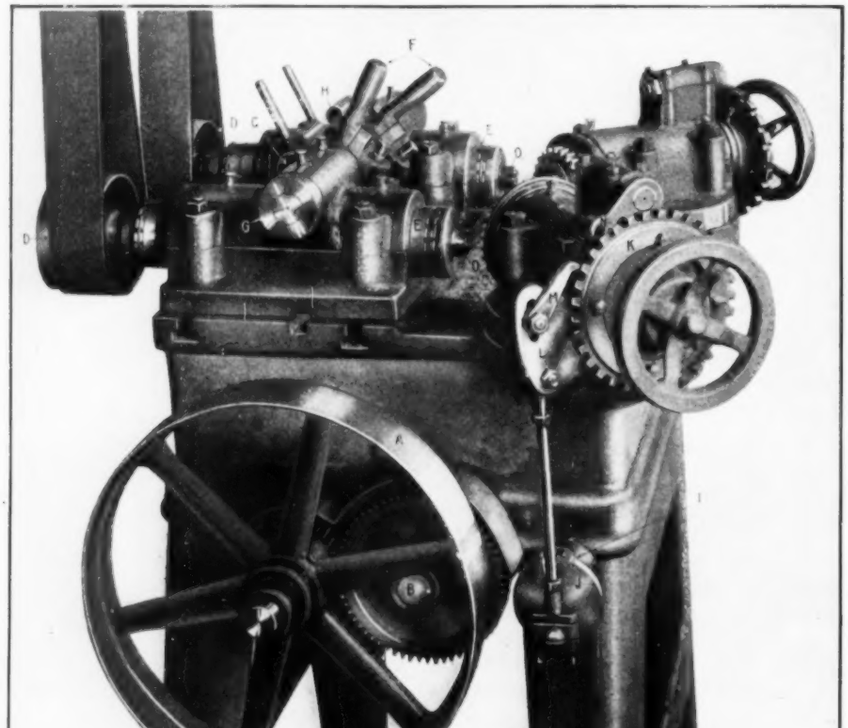
Great care should be used in selecting a furnace for the hardening of high-speed steel as the heat desired for high-speed steel is a heat with as little oxygen as is possible, in fact, the combustion should be perfect. The combustion should be so perfect, that if a highly polished piece were placed in the furnace it would continue to shine and glisten until it was taken from the fire. The only time the tool should be permitted to scale is as it is passed from the furnace to the cooling bath.

If the cooling bath is lead at a heat of 1000 degrees, and the tool is submerged until it has reached the temperature of the lead, it should at once be removed and allowed to cool in the air, or it can be placed in oil to finish cooling. The cooling bath should not be allowed to reach a temperature higher than 1250 degrees, neither should there be any heat applied while the tool is cooling. It is not absolutely necessary to have the bath at 1000 degrees, but for the best results I would say the best temperature for the lead cooling bath is between 1000 and 1200 degrees. There is at the present time two new high-speed steels on the market that the above method has not been tried out on.

# A Double Spindle Tooth Pointing Machine

The halftone shows the new Lipe double-spindle tooth-pointing machine for pointing the teeth of automobile transmission gears. The main drive of the machine is from the pulley *A*, which gears to a shaft *B*, which carries a cam. The cam imparts reciprocating motion to two vertical slotted links *C*, one for each of the cutter spindles.

The cutter spindles are driven by the pulleys *D*. The spindles run in quills *E*, which have teeth formed on their upper parts. The levers *F* are hung on the shafts *G*, which have pinions formed on them which mesh with the teeth formed on the quills. If the levers *F* are thrown back, a lug *H* on each of them engages with the slot in the vertical reciprocating levers *C*.



A Double-spindle Tooth Printing Machine

Mounted on the same shaft *B*, as the cams before referred to is an intermittent spur gear which meshes with a pinion on the shaft *I*, which goes from side to side of the machine. The driving portion of the intermittent gear is so timed that it acts at the time when the spindles are withdrawn from the work and the pinion of the intermittent gear making a full turn and carrying with it the slotted crank disk *J*, the gear to be pointed, which is mounted on the spindle carrying the index plate *K*, is indexed.

The indexing mechanism is a very neat affair. On the lever *L*, which carries the indexing pawl *M*, there is a cam-like lug not shown, which strikes and lifts the locking pin *N* out of engagement with the index plate before the pawl engages with the tooth in the index plate to move it to the next division. The cutters *O* are practically hollow mills but are conical inside instead of parallel. They round the outer halves of two adjacent teeth.

The production of the machine is enormous. One man has pointed 36 33-tooth gears both sides, and 108 18-tooth gears one side, in 1½ hours. I saw a 33-tooth gear pointed on both sides, including time for shifts, in two minutes. This machine was built by the Brown Lipe Gear Company, Syracuse, N. Y., for their own use.

# Williamson Free School of Mechanical Trades

*By Entropy*

The Williamson Free School of Mechanical Trades held its seventeenth annual commencement on March 26, graduating 51 boys out of 70 who entered the class three years ago. These boys were divided among five trades: 14 carpenters, 12 brick layers, 11 machinists, 10 patternmakers and 4 stationary engineers.

Here is a school with 20 years of experience back of it, actually making workmen. It has turned out 777 boys trained in these five trades. In the last five classes sent out, 92 per cent. are still practising their trades, 2 per cent. are in college and the rest are in commercial pursuits for which their training was not intended to fit them. The average pay of these graduates is: Bricklayers, $4.64; carpenters, $3.84; stationary engineers, $3.60; machinists, $3.28; patternmakers, $3.10. With all this success they have simply worked along, evolving a method and working out their own problem and yet have kept so very still that few of us who have been putting our energies into this work for the past few years have realized that here is a real school, turning out real work, making real men.

To be sure Williamson has its own advantages, not shared or likely to be shared by most other schools of similar intent. It had, what to most schools would have been a misfortune, an endowment of $2,500,000. It has a board of trustees forming a close corporation, which was and is composed of business men who have dug their fortunes out of the solid. It has a site in the country, 230 acres of land. It has its boys on the land all the time; that is, it boards the boys. It has its pick for each entering class of 70 to 80 from 400 boys. It has its internal organization of men who are enthusiasts in educational matters; who are practical men and yet who have no lack of appreciation of the possibilities for mischief of the normal boy.

The training of these boys is largely in the shops. It is said to be purely exercise work and it is said that it is not sold. As a matter of observation I should say that they have sold three-fourths of their boys' work to a most excellent customer, themselves. I see little difference between building corn shellers and selling them on the market and using the proceeds to buy engine lathes, and building engine lathes for oneself. The commercial difference is that if you do not need engine lathes it is foolish to build them for yourself and if you do need them it seems too bad to get them by giving two outsiders a profit, one on the corn sheller and the other on the lathe. When they told me that they did not sell a cent's worth of product and in the same breath told me of a building on which they saved $15,000 by having the boys build it I could but smile, internally, of course, at the inconsistency.

### The Machine Shop

In the machine shop, which is the department in which we are most immediately interested, but which appeared to me to be the least strong of any, boys are put to work on purely hand work, most of it what we would all agree on as being exercise work in that it must likely be thrown away. This, however, lasts but a short time. As fast as possible boys are called from the bench on to machine tools, it being the aim of the shop foreman or instructor to keep the tools in operation at all times. The machine work done is largely in the nature of repair parts or rather parts for replacements on the various machines about the place.

When we realize what a large plant this is and how varied the equipment it will be seen that a machine shop with an average of 30 to 40 boys is only adequate as a repair shop for the other branches of the work, and when we consider that instead of repairing a worm or broken part they replace it, it will be seen that they need little work to be sold to outsiders to keep them busy. Their total cost for materials per boy per year is only about $23. What the real returns are in the saving in cost of maintenance I could not find out but it very likely is at least as much as $23.

Everything is nevertheless done as an exercise. That is another way of saying that instead of giving a boy a job involving half a dozen different operations, he is given half a dozen different jobs on one piece. If the boy understands why the different jobs follow each other in certain sequences one way ought to be as good as the other.

The latter part of the course shows work in making punches and dies that is more than creditable and which justifies the hand work done in the early part of the course. This die work consists in the cutting of dies for small key blanks and similar work which involves outlines obtainable only by hand work.

The pattern shop is run on very similar lines to the machine shop. The work done is the making of patterns for breakable parts of machinery and apparatus used in the other departments of the school. The boys do very careful and expert work.

### The Building Trades

But it is in the carpentry work and bricklaying that the school shows its greatest strength, and it is just there that the most commercial work is done. They have built a shop something like 60 by 120 feet, four stories high, a double cottage accommodating 30 or 40 people, a barn, a pump house and so on. In fact, for many years they have done all their building work themselves. The cost has been simply the cost of material plus architects' fees and the cost of such work on the building as comes under trades other than those taught in the school. The boys in the first year do not work on permanent structures. They work in the basement of the shop on plain 4-, 8- and 12-inch walls with returns and partition walls, plain arches and simple corbels. The work is torn down and rebuilt as often as necessary so that the boy may have abundant practice. During the second and third years the boys proceed to actual construction where poor work is torn out and done over again at once and where the boys realize that it is to stand for years a monument to this ability. The result is remarkable.

### The Men in Charge

Now what kind of men are making the thing go? This is the most natural question, for we all realize that any number of millions in the wrong hands would simply mean a large noise when the school collapsed. Land, buildings, equipment mean nothing without the men to push things along. The answer is, these men are all practical men with long shop experience. They are teachers, but not professional educators. When Williamson wants a professional teacher she hires a woman who is a college or normal school graduate. When she wants a man she hires one from the shops. Do not for a moment suspect from this that every shop man makes a successful teacher, for those who can are few and far between. They are there and it is Williamson's task to find them and gather them in. To succeed their teachers have to be good workmen, to get along well with boys, which means patience and perseverance, and on account of the exercise method of instruction they must be able to analyze their work and arrange it systematically, not that this last is undesirable in any shop or any school, but that it is peculiarly necessary at Williamson.

### The Boys

The boys! Yes, the boys have everything to do with the success of this or any other school. They are a healthy looking lot, full of life and fun but appreciating that their working time is for work. They are a picked lot to be sure, but they are also apparently steady and faithful of their own accord. They have to pick their trade before they enter and yet they lose but a small part of their number during the course; 70 to 75 per cent. of the boys who enter, stay and graduate against 50 per cent. as is customary in higher institutions of learning.

The only fault that I could find with Williamson is that they have so steadily refused to blow their own horn. To be sure they have had more applications for admission than they know what to do with, but it seems as if they have failed of doing a vast deal of good to the world at large that might have benefited from their experience. With their great endowment their problem is not the general problem that confronts the mechanical people of the world, but their methods have much that is worthy of vastly more study than has been given them by people in general.

# Teaching Practical Trigonometry in the Lathe

We feel perfectly justified in saying that much of the success of the Cincinnati Continuation School, which is attracting so much attention at present, is due to the instructor, J. Howard Renshaw, and his assistant, George Wooley. As an evidence of this, the illustration in Fig. 1 is given to show how mathematics, which are usually considered difficult and beyond the shop man, are taught in a thoroughly practical way, by showing how they are applied in every-day use.

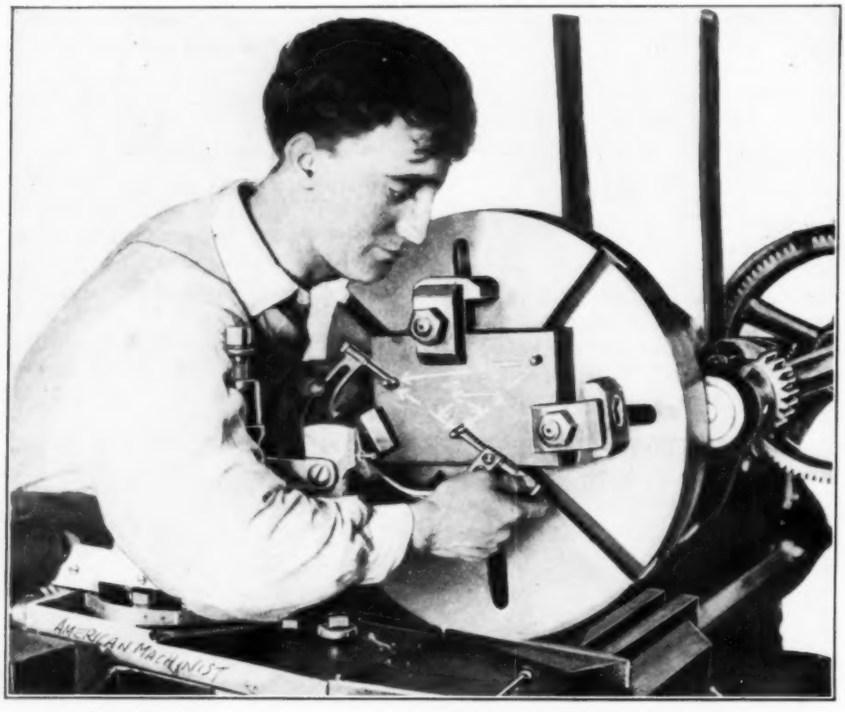



FIG. 1. USING MICROMETER AND BUTTONS TO LOCATE HOLES CORRECTLY

The student shown is not an apprentice, but a young man out of his time, who insisted on going to the school, and was ready to throw up his job, if necessary, to do so.

He is proving to himself that trigonometry has a practical place in machine-tool work, by locating three holes in a fixture, at the exact points desired, when the dimensions given are as shown. A set of Starrett's "buttons" are being used and he is measuring the distance to see that they are located correctly as shown by his figures.

The diagram illustrated in Fig. 1 is also shown in Fig. 2 where the buttons are supposed to be at the points *W*, *X* and *Z*. The length *X Z* is 6⅛ inches, the length *Z W* is 4 inches, the angle *Z W X* is 130 degrees. The problem is to determine the length of the line *X W*. Extend the line *X W* horizontally, to *Y* and erect a perpendicular *Y Z*. Now as the angle *Z W X* is 130 degrees and the line *X W Y* is a straight line, we have that the angle *Z W Y* is 180 degrees minus 130 degrees, or 50 degrees.

In order to get the length *X W*, we have first to find the length *X Y* and to subtract from this, the length *W Y*, which must also first be found. The length *W Y* is equal to *Z W* cosine 50 degrees, which, from the diagram and from the table of trignometric functions, is; 4 × 0.64279 = 2.57116 inches.

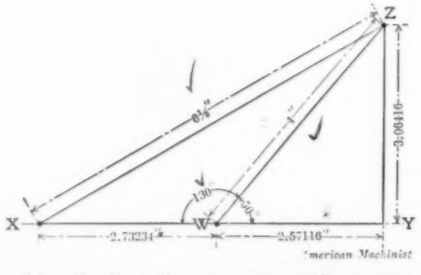



FIG. 2. THE DIAGRAM WITH FIGURES

From the same reasoning distance *Y Z* = 4 sine 50 degrees, which equals 4 × 0.76604 = 3.06416 inches.

The distance *X Y*, by the principles of the right-angle triangle, will be the square root of $(X Z)^2 - (Y Z)^2$. This is $(6\frac{1}{8})^2 - 3.06416^2 = 37.515625 - 9.389077 = 28.126548$. $\sqrt{28.126548} = 5.3035$. This is the length of the line *X Y*. Subtracting the length *W Y*, which equals 2.57116, we have that the length *X W* equals 2.73234 inches.

This is the length between centers, which is wanted, but as the distance measured by the micrometer is over the outside of the buttons, the length shown on the micrometer will be greater than this, by the diameter of one of the buttons, or ½ inch. The reading of the micrometer will therefore be 3.23234 inches.

## Hardening Carbon and Low-tungsten Steels

In a paper presented before the Institution of Mechanical Engineers by S. N. Brayshaw, dealing with the hardening of carbon and low-tungsten tool steels, were the following conclusions:

In the light of the experiments recorded in this paper it cannot be supposed that most of the articles so hardened reach anything like their maximum efficiency, for it has been shown that slight variations in the heat treatment previous to quenching have a profound effect upon the condition of the steel, and furthermore, the previous treatment, by annealing or otherwise, to which the steel has been subjected, may powerfully influence the final result.

It has been demonstrated that, so far as bending tests are concerned, it is, on the one hand, easy to harden so as to produce a good bar, but, on the other hand, the production of the best bar necessitates a degree of accuracy beyond what can be attained by sight alone. It must not be supposed that the author is advocating that all tool-steel hardening should be carried on with the precision necessary to bring the steel into its best condition. Many tool-steel articles are perhaps good enough when the hardening has been performed within a range of 120 or even 150 degrees Centigrade (216-270 degrees Fahrenheit).

# Interesting Ways of Making Molds for Glassware Products

*Die-sinking Processes with Many Kinks of Unusual Interest*

By E. F. Lake

The making of the molds in which the glass ware of the kind shown in Fig. 1 is molded, is a very interesting job, and one that requires a great deal of skill on the part of the mold makers. It is one of the jobs that has bred specialists in this line of work, even though it be the same class of work that the die sinkers are accustomed to, and capable of doing. Many little kinks are met with in the making of these molds that do not appear in other kinds of die-sinking work.

Among the glass ware shown in Fig. 1 will be seen two plaster casts. These are made before starting a mold, and they are made in the exact size and shape that the finished piece of glass is to be; after which the design is carved on them. While the mold maker is making the mold, he always has these in front of him to take his measurements from. The workmanship on these molds is very exact, and every impression cut or sunk in must be perfectly true to shape, size, depth, width, etc., in order to make the figure on the glass as nearly perfect as possible.

FIG. 1. MOLDED GLASSWARE AND PATTERNS

### THE CRUCIBLES AND GLASS

The Duncan & Miller Glass Company, of Washington, Penn., in whose shop this work was done, has always made a specialty of high-grade molded glass ware. Their glass is made in clay crucibles, with a capacity of 10 tons, that take something like a year to make, as they are only built up 1½ inches at a time, and allowed to dry thoroughly before another course is put on. It has an opening in the side close to the top for the insertion of the materials and the taking out of the glass. When a new crucible is put into use, at least 8 hours is consumed in gradually raising the temperature up to a working one, so as to prevent its cracking.

This excludes all fuel gases from the glass, and allows no foreign substance to be absorbed in its making. A product is thus turned out that has absolutely no color, and is clear as crystal. In fact, the glass ware turned out by this firm is so nearly like cut glass that it takes an expert to tell the difference; thus one can realize the necessity of having perfect molds in which to make the different pieces.

### OPERATING THE PRESS

The molds are used in a press that has a bed plate, on which to fasten the molds proper, or that part which forms the outside of the glass ware; and a spindle movable up and down, to which is fastened the plunger that gives the glass piece its form on the inside. When set up in the press, a chunk of glass, that is heated enough to be pasty, is thrown into the mold and the plunger squeezed down into it, thus causing the glass to fill all the depressions in the mold and be the exact shape of the inside of it, when taken out.

The molds are made of cast iron, owing to the fact that steel oxidizes too much to be of any practical use. None of the softer metals can be used, owing to their not being able to stand the heat at which the glass must be molded.

### THE MOLD CASTINGS

In making the castings, patterns similar to those shown in Fig. 2 are used. Here *B* is a pattern for the casting that forms the outside of a water-bottle mold similar to the one that is being built up in Fig. 4. *A* is a chill that is used to chill the inside surface of this casting so as to make the iron more dense and give it a finer grain than is obtained in the ordinary casting, on the surface in which the depressions are to be cut, that the glass is pressed into.

At *C* and *D* is shown the pattern for the plunger casting. This casting is molded on end in order to get better iron around the outer surface that forms the inside of the molded glass piece than would be the case if the pattern was split lengthwise, and one side molded in the cope. The pattern is made in two parts in order to let it come out of the sand more easily.

For making these castings, the cupola is charged with No. 1 foundry or furnace iron, and a little hard iron is thrown in to give the castings greater hardness.

### TEMPERATURE OF MOLD WHEN WORKING

Allowances must be made in the designing of the pattern and the making of the molds for expansion and contraction, as when molding glass the mold is kept at a heat that just shows red in the dark. This is a part of the glass molder's job who heats the mold up just before starting, to the proper temperature. It is maintained at this temperature by the hot glass that is being molded.

If the mold is too hot, the glass sticks

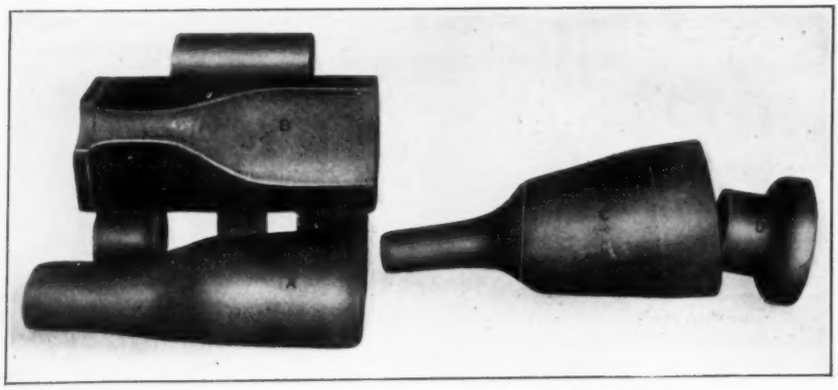


FIG. 2. CHILL AND PATTERNS FOR MAKING MOLD CASTINGS

to it, thus destroying the piece, and if too cold, the glass chills too quickly, making the surface wavy and not transparent. The piece, therefore, does not present that clear, crystal-like appearance that is desired.

### MACHINE WORK ON THE MOLDS

The outsides of these molds, when a fancy figure is to be molded in the glass, are made in 3, 4, 5, 6 and 8 parts, according to the design. The first job on the castings is to machine the sides of each piece, as shown at *E* and *F*, in Fig. 3, and then fit the hinges and drills for the hinge pin, so that the several pieces will form a true circle, and the joints *E* and *F* be an absolutely tight fit, in order not to leave any mark on the glass piece when it is molded.

After fitting the pieces together, the mold is turned to shape on the inside, and then polished. The slightest flaw or pin hole on this turned and polished surface will condemn the casting, unless it is of such a nature that it can be plugged. Thanks to the chilling process, and the care used in mixing the iron and casting it, the pin holes that usually show in iron casting, very seldom appear in these.

A close inspection of the turned surface on the mold shown in Fig. 3, which was photographed just as it left the lathe, cannot detect any sign of pin holes, blow holes, spongy iron, etc., but a fine-grained iron with an absolutely smooth

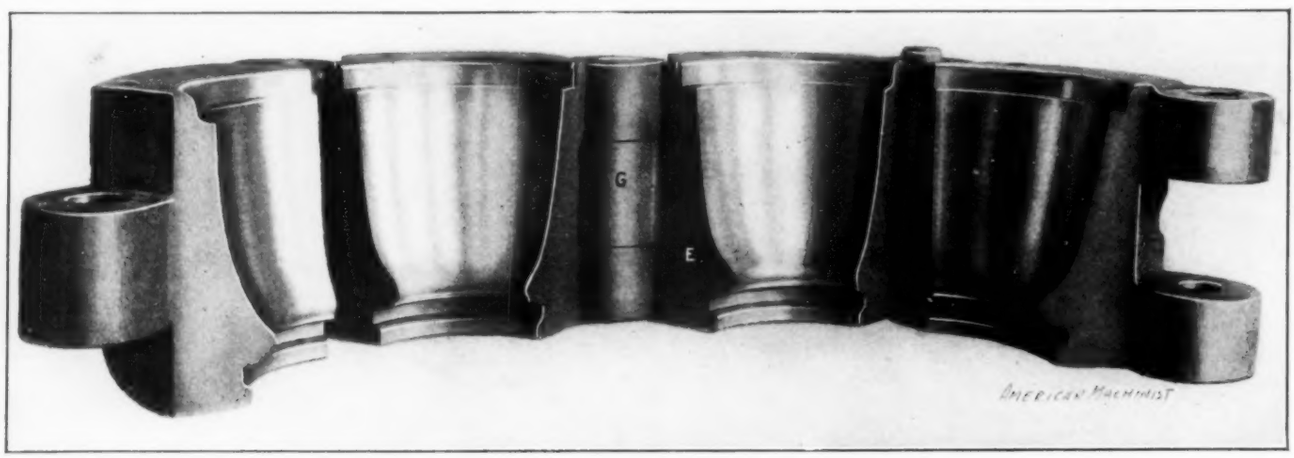



FIG. 3. FOUR PART MOLD SIDE AFTER TURNING AND POLISHING

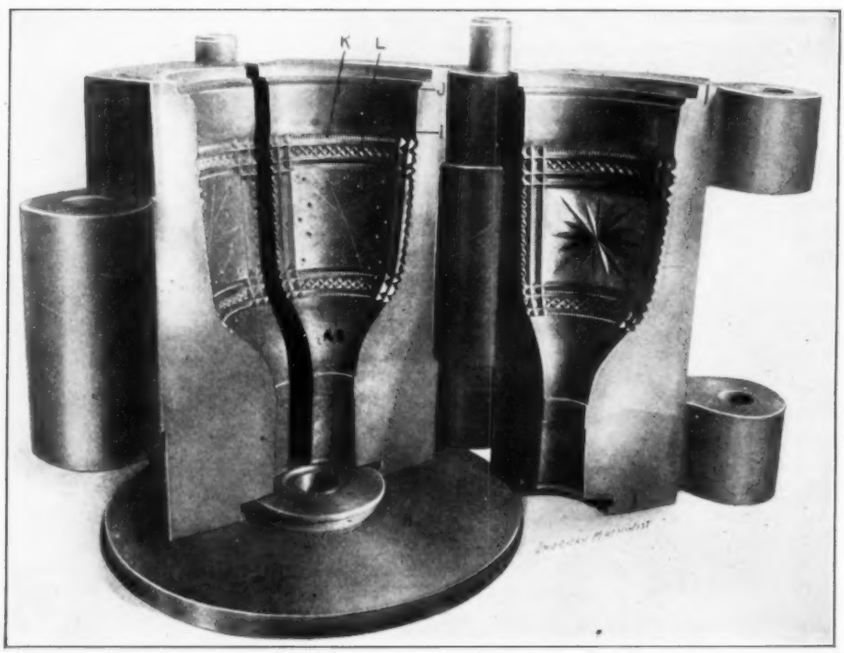



FIG. 4. COMPLETED AND PARTLY FINISHED MOLD SIDES FOR WATER BOTTLE

surface is shown; nor do any of these defects show in the other fixtures of molds and mold parts. And at that the losses between the tapping of the iron from the cupola and the finished glass mold are less than 2 per cent.

This might be an object lesson for some of our machine-tool builders, as I have frequently seen the wearing surfaces of cast-iron machine parts, such as the ways of a lathe, in which occurred blow holes, pin holes, porous spots, hard spots, etc., thus lessening the wearing qualities, and making the machine run out of true in a short time.

### FITTING THE BOTTOM PLATE

After the mold sides have been fitted together and turned, a bottom plate, simlar to that shown at *H* in Fig. 4, is turned to fit the mold sides, so they will grip it and hold it in place when the mold is closed. This bottom plate also gives the glass piece its shape at the bottom, which in this case would be the top of the neck of the water bottle, as it is molded upside down.

The bottom of the bottle in this case

FIG. 5. FIVE-PART MOLD SIDE FOR 14-INCH PUNCH BOWL

would be at *I*, but as the bottom must be left open in order to get the plunger out that forms the inside of the bottle, the glass is molded up to the line *J*. After the water bottle is removed from the mold, the glass between the lines *I* and *G* is reheated, and this is turned over by hand and welded together in the center, to form the bottom of the bottle.

### ENGRAVING THE FIGURES

As is shown by Fig. 4, the border around the center figure is first worked in the mold sides, which are parted in the center of the border. The greater part of the border is cut out to shape with some of the numerous sizes, shapes and styles of chisels that are used by the moldmakers; but parts of the design, such as the corrugations at *K* and the cross lines in the bottom of the square at *L*, are formed by indenting the metal with chisels that are shaped especially for this.

The forming of these corrugations by

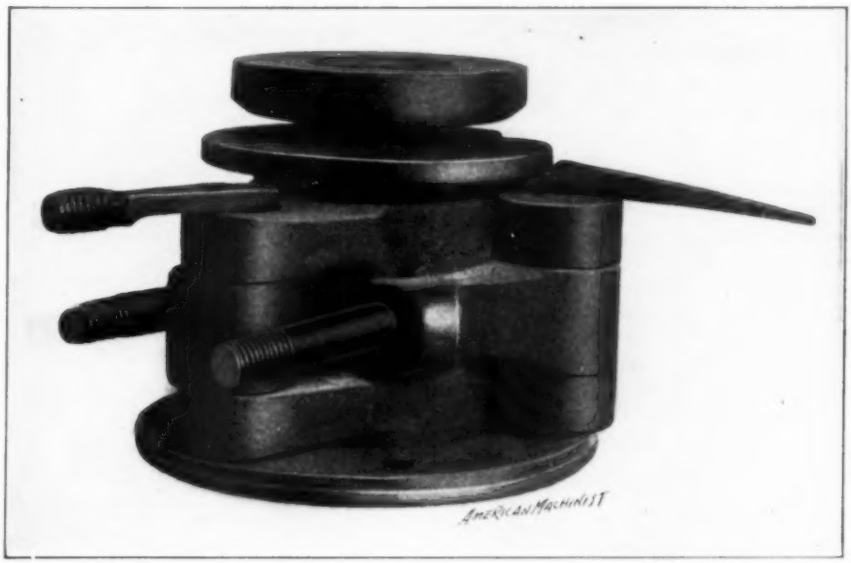


FIG. 7. LAMP-SHADE MOLD CLOSED FOR PRESSING GLASS TO SHAPE

FIG. 6. COMPLETE MOLD WITH THREE-PART SIDE FOR MAKING TUNGSTEN LAMP SHADES

indenting the metal is probably the most delicate part of the work, as after the first impression is formed at one end, to form the second indentation would mean the breaking off of the tooth-like ridge unless great care was used in doing the work. To depress the second indentation, as well as the succeeding ones, the point of the chisel is started ahead of the center and the chisel is driven at an angle down into the iron and away from the first indentation. The top and bottom of these corrugations, as well as the bottom and parts of all the rest of the figures, must be absolutely sharp in order to give the glass the effect that cutting does in cut glass.

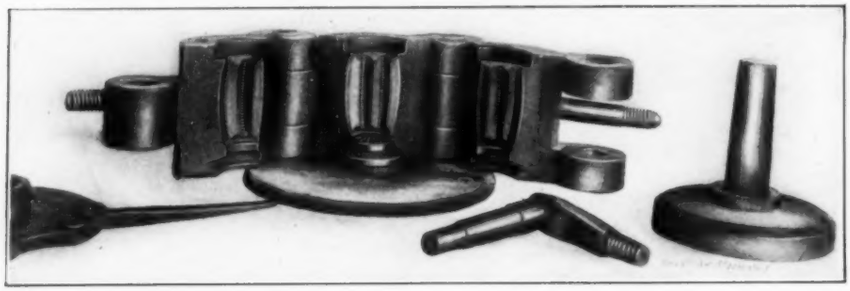


FIG. 8. COMPLETE SALT-SHAKER MOLD OPEN

Another delicate part of the mold to form is that part of the figure that comes on the parting line, as the sharp edges are liable to break off, but the two pieces are clamped together so that the joint is tight and the figure is then cut and stamped in. The method of laying out the central figure is shown on the two left-hand pieces of the molds and the finished figure is shown in the right half piece.

### SOME OTHER MOLDS

In Fig. 5 are shown the five part sides of a mold, with its bottom plate, for molding a 14-inch punch bowl. In this mold the bottom plate forms the bottom of the bowl. The top edge of the punch bowl is formed by a piece that sits down into the mold, when the sides are closed.

In Fig. 6 are shown all the pieces that go to form the complete mold for making tungsten lamp shades. Owing to the figure that is pressed into this piece, the side of the mold can be made in three parts. The circle to the left fits into the mold when it is closed to form the edge of the piece. It is located by the dowel pins shown and pointed rods on opposite sides are for handles to lift it off with. To the left is shown the plunger that forms the inside of the glass piece, and the piece lying in front of the mold is an eccentric hinge pin, that when slipped into the hinge hole and given a quarter to a third turn locks the side pieces together so the joints will be tight.

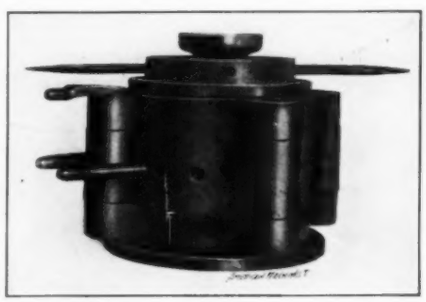


FIG. 9. SALT-SHAKER MOLD CLOSED

This mold is shown closed in Fig. 7, which is the position it will be in when forming the glass piece; but the mold part is fastened to the bottom of the press and the plunger is fastened to the spindle.

In Fig. 8 is shown the different parts of a complete mold for making salt shakers, and Fig. 9 shows the mold closed.

The plunger, mold and top ring for molding a glass fruit dish are shown in Fig. 10. In this the mold proper is solid with plain sides. It is completed in the lathe by turning and polishing, with the exception of the figure in the center of the bottom, which is cut by the moldmakers.

FIG. 10. SOLID MOLD FOR PLAIN GLASS FRUIT DISH

### SUMMARY

After these molds leave the moldmaker's hands, all the surfaces on which the glass piece to be molded has a bearing, even down to the smallest surfaces in the corrugation or other parts of the figures, are polished with Hindoostan stones, with petroleum for a lubricant. This work is done by girls and they produce a surface as finely polished as anyone could.

When not in use the molds are kept in a vault that is maintained at a permanent temperature of 70 degrees Fahrenheit. The vault is located under some ovens that are used in the manufacture of the glass ware, and three large gas jets are kept burning inside of the vault, so that no moisture nor frost can attack the molds and produce rust, as when once rusted the molds are spoiled. Some molds were shown me that had been in this vault, when not in use, for 10 years, and no signs of rust were seen on any of them. As some of the molds cost as high as $300 and several thousand of them are kept in this vault, a large pecuniary loss would result if they were not protected in some way from corrosion.

The subject of engraving and die-sinking machines for doing this class of work has been thoroughly threshed out by this firm, but as only one mold of a kind is made, it could not be seen where the machines could be used practically or any economy effected, owing to the fact that it would be necessary to cut out or die sink a master piece for the tools in this engraving machine to follow, and this master piece would have to be perfect.

## Copper and Steel Billets

The production of compound copper and steel billets, which are particularly desirable in electrical manufacture, has not until lately been successfully accomplished.

According to an article in the *Brass World* the trouble has been found to be due to oxide formed on the steel when the molten copper was cast around it. This oxide effectually prevented a firm union of the two metals.

William M. Page, of the Duplex Metals Company, of Philadelphia, Penn., has succeeded to a remarkable extent, by first sandblasting the steel and subjecting it to vapors of zinc, out of contact with air. The result is said to be a strong and positive union when the copper is cast over the zinc coating, this union being sufficient to resist sharp bending at the joint.

# An Unusual Job on the Automatic Screw Machine

The connecting-rod bolt illustrated in Fig. 1 is being made in the Ford automobile plant at Detroit, Mich. The bars are fed into the screw machine and the piece milled and drilled as shown is dropped from it without being touched by hand. This is accomplished by a combined milling and drilling attachment which operates on the piece before it is

FIG. 1. THE BOLT

cut off and while the other tools are forming, milling and threading it. It is done on a No. 52 Acme four-spindle automatic screw machine of ¾ inch capacity. The attachment is mounted on the cutoff tool slide as shown in Fig. 2, and operated in the third (threading) position as shown in Fig. 3.

The milling cutter and drill are set close together and the cutter mills the head of one screw while the drill pierces the bar back of the cutoff which is afterward turned down to size and threaded for the next screw. One of the screws which has been cut off to show the method may be seen on the attachment frame in Fig. 3. The rehandling of this piece for milling and drilling is saved by the use of the simple attachment shown. The pieces are made at the same speed as without these operations and the machine requires little more attention.

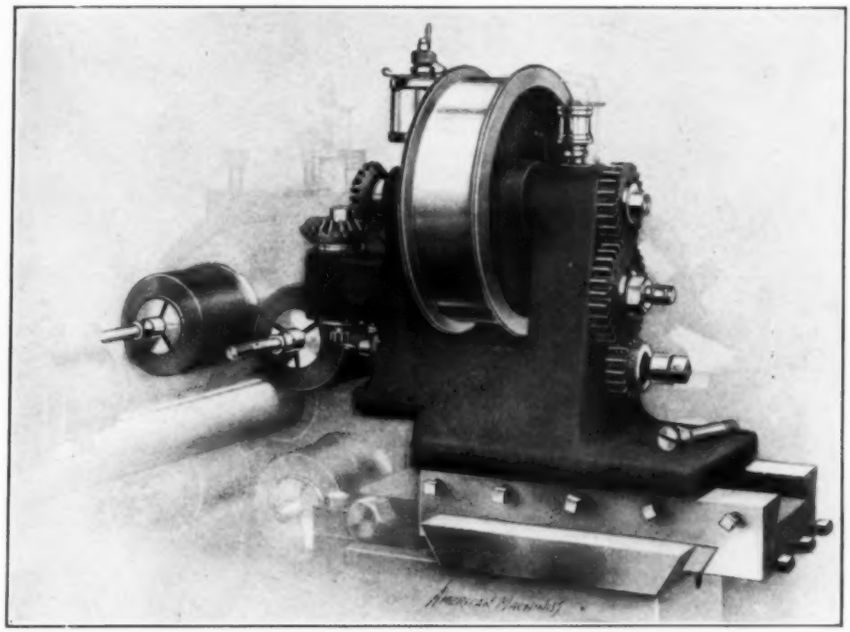


FIG. 3. SIDE VIEW OF ATTACHMENT

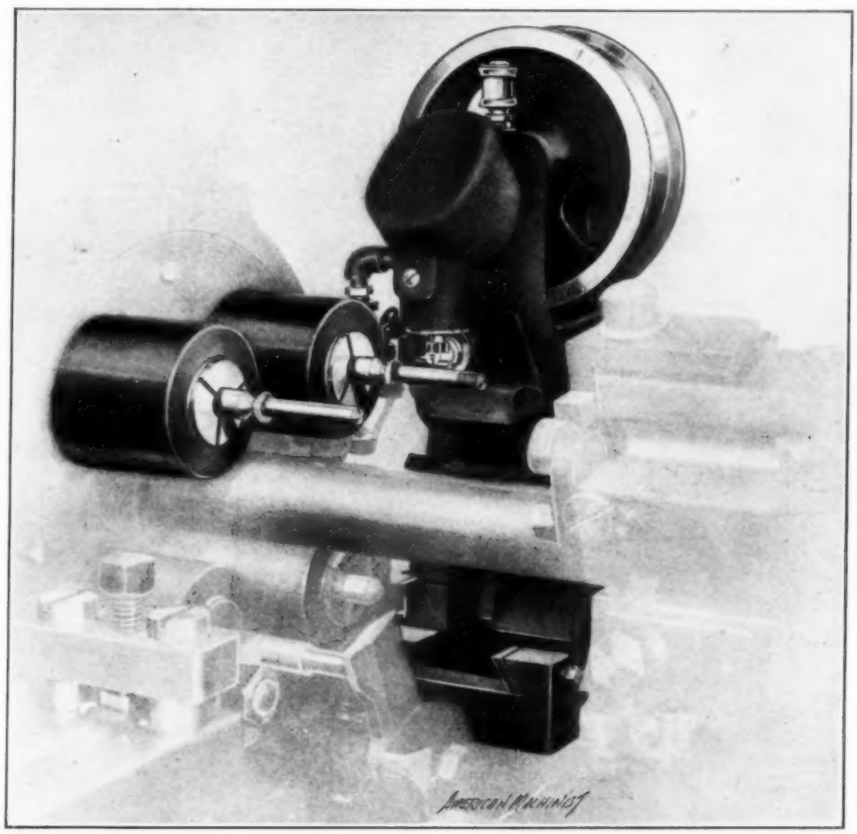


FIG. 2. MILLING AND DRILLING ATTACHMENT ON ACME AUTOMATIC SCREW MACHINE

This is one of a number of similar attachments which the makers of this automatic, the National-Acme Manufacturing Company, Cleveland, Ohio, have been able to fit to the machine because of the design which permits of the stopping of each of the four spindles when in the third position.

East Indian jewelers often use screws as fastenings for bracelets and anklets of silver and gold. The peculiar thing about these screws is that they are almost invariably left-hand. This comes from the method of making and because most people are right-handed. A piece of wire is taken the body size of the screw. It is held in the left hand and two pieces of round or square wire the size of the thread are wound around it. After one of the threads has been carefully removed the remaining thread is hard soldered to the body. The thread which was removed is put inside a cylindrical piece of silver and after being hard soldered in place it forms the nut or seat for the screw.

The following definition may help some to a better understanding of the term reinforced concrete, which has now become such an established material: Concrete in which iron or steel shapes are imbedded to add strength and economize material.

# Some Ingenious Economies of a Small Shop

*By T. A. Sperry*

We fellows of the big shops with expensive machines, high-priced workmen and elaborate organization, are apt to get into the way of thinking that we know about as much as can be known about shops, tools, methods and economical production. We are apt not to give "the little fellow" credit for much or any ability or ingenuity. It is not always safe,

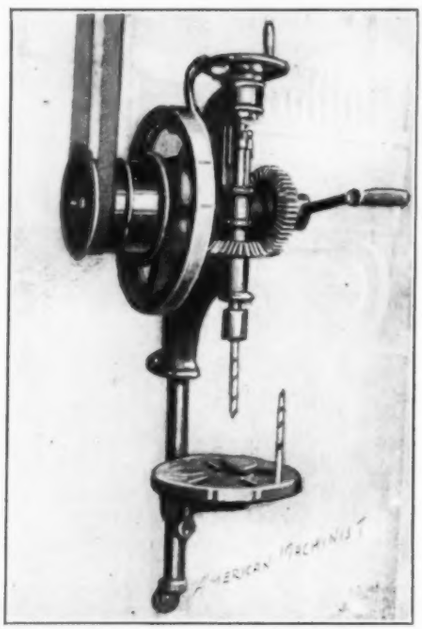


FIG. 1. POST DRILL ARRANGED FOR POWER DRIVE

however, to guess, from size alone, just how far a mule can kick, for the little fellow will often reach you when the bigger one falls short of it. Many of us read with interest and profit the story of Sammy's shop, which has appeared from time to time in the AMERICAN MACHINIST, but most of us do not often have an opportunity to look into some of the other little shops around us and see what some of the other Sammies are doing. A description of some interesting observations recently made in such a shop may, therefore, be of interest.

In this case, even the shop building itself is unique. It is only about 25x50 feet outside, yet its owners claim it is the warmest shop in winter and the coolest in summer, of any shop in the State. Its walls are double and about 16 inches thick, the outer boarding being put on vertically and fastened to 1x14-inch horizontal boards. The inner wall is made in tight-fitting panels which raise and lower vertically. This makes a set of inclosed cupboards entirely around the building. Then, to gain additional floor space, a balcony was built across each end of the room and the joists floored over to form an attic, making practically a three-story building of a one-story one.

Power is derived from a horizontal gas engine and to eliminate the vibrations of this from the other tools the shop floor was cut away and four 4x4-inch cedar posts set in the ground in concrete, the whole boxed in, planked over and filled with grouting. This makes a very cheap, yet thoroughly substantial foundation, entirely independent of the rest of the building.

As economy is paramount here, many ingenious schemes have been developed to accomplish results at a minimum first cost. Among these, the power drive for the Advance post drill, as shown in Fig. 1, is worthy of notice. The long hub of the flywheel of the original hand-power drill, was turned outward, so it extended over the end of its original shaft and a short piece of cold-rolled steel was securely fastened in this extended hub. On this extended shaft are mounted a pair of tight and loose flanged pulleys taken from an old harvester apron shaft, with the tight pulley bolted to drill flywheel for added strength and security. A 2-inch belt is used and the drill may be driven by either hand or power, or a combination of both, for extra heavy work.

This drill is used for holes from 3/32 to 1 1/16 inches diameter and we may well protest against the doubtful policy of having only one speed (with variable feed, however) for this range of work, but the machine is found very efficient in spite of this limitation. For instance, a lot of ⅛-inch holes were to be drilled through the flange of 2-inch steel angles and actual timing showed that these could be drilled at the rate of 8 holes a minute (about 5 seconds each, actual drilling time), while at the same speed it was found easy to drill ⅞-inch holes in steel at the rate of 1½ inches per minute.

For small holes, 3/32 to 3/16 inch diameter a special socket to fit the square shanks of brace drills was made by heating and squaring one end of a 2-inch piece of extra heavy ¼-inch pipe and turning the other end to fit the socket of the drill spindle. This socket, with drill in place, may be seen in the halftone, standing on end on the drill table.

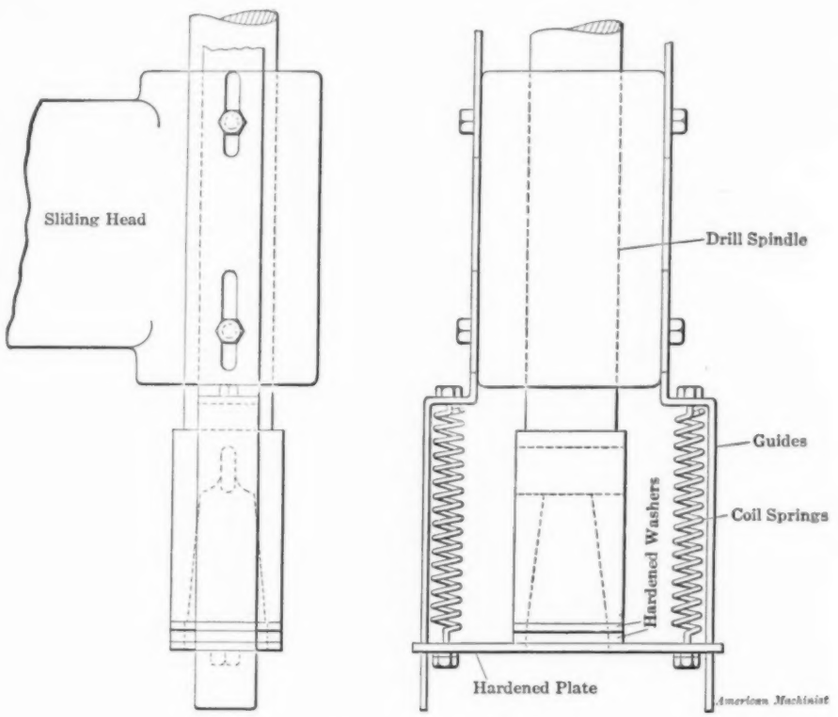



FIG. 2. TAKE UP FOR DRILL SPINDLE

Another drill-press feature noted was a lost motion take-up, as shown in Fig. 2. A very frequent objection in a drill is the lost motion, or vertical play of the spindle. Ordinarily this does but little harm, but there are times when it is a serious matter, as, for instance, when enlarging oblong holes into which the drill may drop at certain portions of its revolution. To avoid this, the take-up here shown was devised. A long, slotted bar was secured to either side of the lower spindle bearing, and a coil spring of suitable size attached to each. A hardened washer was pinned to lower end of drill spindle and a hardened plate attached to lower ends

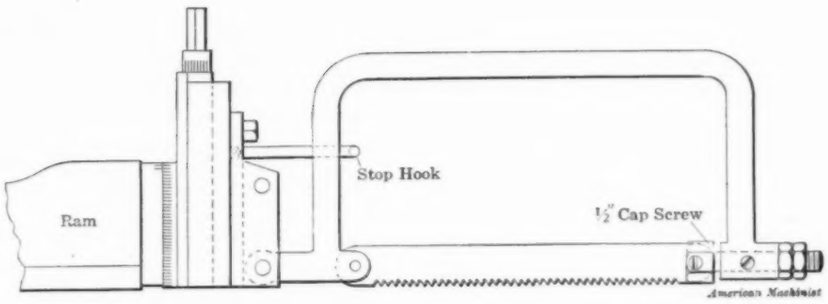



FIG. 3. SHAPER CONVERTED INTO A POWER HACK SAW

of the coil springs. The plate, drawn up by the springs, supported the spindle, holding it raised at all times and also allowed a certain amount of travel or feed, while any range of travel could be obtained by adjusting the side bars. A hardened steel washer was put between the plate and the washer on the drill spindle, for wear.

A small but convenient device in use on a traverse shaper is that all nurled knobs for feed pawls have been marked with two distinct arrows, one on each side of the barrel. These are so placed that the operator can see at a glance and without changing his position, in just which direction this feed will travel the cut.

This shaper has also been adapted for use as a power hack saw by forging a saw frame to fit in clapper box, as shown in Fig. 3, after clapper box and tool post have been removed. A special hole was drilled in lower end of clapper box, and a pin inserted on which the saw frame is mounted. This gives a long bearing to hold saw vertical. The saw cuts by its own weight or it may be loaded, and it can be adjusted to work by down-feed screw. Stroke and speed are varied by shaper ram and saw is prevented from dropping, or cut may be stopped at any specified depth by means of a hooked rod tapped into shaper slide. The saw tightener bolt is a ½-inch cap screw with head split to receive saw blade, and prevented from turning by small set screw in saw frame.

As socket wrenches were not available for many sizes, a very good substitute was found in the form of extra heavy gas pipe of various sizes, by heating one end and swaging it over the head of the bolt or screw for which it is to be used. When extra strength is needed these socket ends are tightly wrapped with a thin layer of fine wire, the ends of which are held by a drop of solder. A hole is drilled through the other end of this pipe and a piece of smaller pipe driven in to make a handle.

Another device noted was a support for very small drills for breast-drill use.

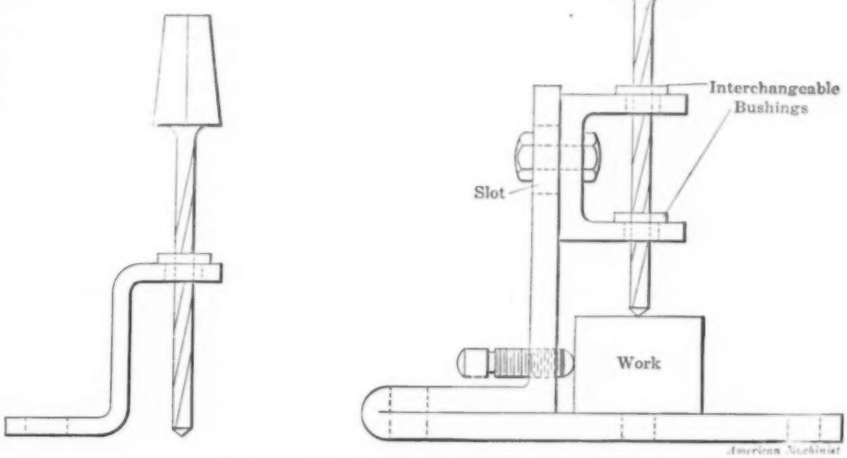



FIG. 4. GUIDES FOR VERY SMALL DRILLS

With drills from 1/32 to ⅛-inch diameter it is difficult to get sufficient pressure to make drills cut without danger of bending or breaking them. To avoid this a small support is used, two forms of which, made from strap iron or light forging, are shown in Fig. 4. The support is clamped or bolted to the work, or drill table and serves not only as a support for the drill, but for a guide, or jig, as well. The double lug bracket may be raised or lowered to suit the work, and work gaged by set screw as shown.

Still another ingenious device in the way of special machines, is one for making the saw kerfs and cross holes in the wooden grips shown in Fig. 5. The machine is shown in Fig. 6. The power is derived from a small, two-head, emery-wheel stand, on which the emery wheels have been replaced by two grooved wheels, driving ⅜-inch round rawhide belts. One pulley drives direct to a small grooved pulley on the end of a drill spindle, driving the ⅛-inch drill at about 7000 revolutions per minute. This shaft is horizontal and has an endwise movement of about 1½ inches, controlled by the bent lever connected to the handle. The other pulley on the emery-wheel stand drives through an automatic take up and belt tightener, two horizontal saw arbors placed vertically, one above the other and both mounted on a horizontally traveling head with about 2½ inches travel. The saws are about 1¼ inches diameter by ⅛ inch thick and run in opposite directions at 9000 revolutions per minute. This saw head, or carriage, is traveled by a rod connecting it to the same bent lever and handle that controls the endwise motion of drill spindle.

The grip to be cut is fed by the left hand into a grip chuck near the center of the machine and the chuck tightened by a foot treadle. The operator then pulls the bent lever with the right hand. This advances the two saws and cuts the two vertical kerfs, while simultaneously, the drill advances horizontally through a guiding opening in the chuck and bores the horizontal hole. Throwing back the lever forces the saws back (a weight keeping the belt tight) and withdraws the drill. Releasing the foot lever opens the chuck jaws by means of a

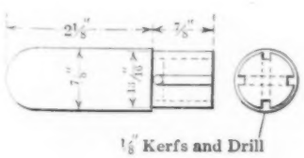



FIG. 5. THE GRIP TO BE KERFED AND DRILLED

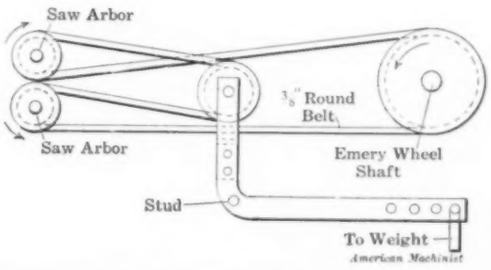



FIG. 6. DETAILS OF SAW DRIVE AND BELT TENSION

spring and cam, just so the operator can turn the grip one-quarter revolution until the kerfs are engaged by spring pawls. The chuck is again tightened and operation repeated, thus sawing the four kerfs and drilling the two holes at 90 degrees with two short motions of the one lever. One boy kerfs and drills about 800 grips per hour which is not bad work for a machine costing less than $100 and giving a product that is straight, true and uniform.

For quick, light tool edging, or other very light grinding an ordinary electric fan motor has, instead of the fan, a small emery wheel mounted upon its shaft. A very simple wooden flange and cap screw are all that is necessary to adapt the fan to this purpose.

A quickly made and inexpensive drill for boring holes in brick walls, was made by taking a good piece of ¾-inch gas pipe, filing notches like rip saw teeth around one end and case-hardening in a cyanide bath. One such drill observed had cut 16 holes through a 13-inch brick wall and was still in fairly good condition. In medium soft brick this drill will cut holes through a wall of this thickness, in from 6 to 12 minutes each.

Another economy is in the use of gas pipe for drill-jig bushings. The pipe is bored (or drilled) to size, hardened and may then be ground to absolute size, or not, depending upon the degree of accuracy required in the jig. It may further be said that this firm uses nothing but white lead for tap lubrication, on all steel or steel casting tapping and it is found that taps last longer, remain truer to size, cut easier and give better threads, with white lead lubricant than with any other preparation so far discovered.

Many economies practised in this shop are not necessary, or even desirable, in a larger, reasonably modern establishment, but there are still plenty of "Sammies" in the country who can well follow the lead of this one and there are a great many hints in these close economies that may well be considered in large shops.

# An Unfortunate Type of Inventor

*By Samuel L. Platt*

Webster defines an inventor as "One who invents, one who contrives." This is quite true but rather incomplete, as the average inventor has many attributes, not covered by the above. If patents were issued for all his original ideas, schemes and inventions, the Patent Office would have to be enlarged to many times its present capacity. He is apt to think he has a new and better way of doing any and everything, no matter what it may be. Complicated matters that would worry and fret the average business man, he takes up with extreme confidence, relying on his power of invention to carry him through. Lack of experience is seldom a drawback as far as he is concerned. Evolving, as he does, everything from his own standpoint, he never seems to think that the experience, training or ideas of another are of any value whatever, nor does he even realize that the lawyer, business man and salesman are just as necessary to the success of his invention, as he is himself; the same as the intermediates in a train of gears are necessary.

### His Invention

No matter what his invention is, it is the one thing that the human family must have to insure its further progress; the one thing that the world is standing with open arms ready to receive the minute he sees fit to present it.

With his keen perception he saw this great need and set to work immediately. By diligent effort, careful study and experiment, he has evolved in his mind the very thing to meet this requirement and it is all finished—with the exception of one minor unimportant, insignificant detail that will only take the fraction of a second to perfect just as soon as he can spare that amount of time.

The demand will not have to be created, because he answered the call of the world for this one thing to complete the development of the age. The sales, figured on the population of this continent and augmented by the European countries and the world at large, are wonderful when viewed through his eyes. There seems to be just as great a field for the invention, whether it is some attachment to a sewing machine or even a Lick telescope; if the latter, it will necessitate one in every well regulated family. "Think what that means."

The invention is simplicity itself, nothing ever approached it. "A child, even the merest infant, can operate it." With the model before him he demonstrates this—a lever moved up, a handwheel turned three quarters of a revolution to the right, a thumb screw loosened, an indicator set to its proper place on a dial and it is ready to do its work—with, of course, that one little exception mentioned above. On the back of an envelop he shows how he had thought of doing, before he realized that there was a simpler way, not yet quite perfected in his mind. Just as soon as this is taken care of, he is going to put in his application for a patent, but in the meantime is arranging for the stock company to manufacture it.

### The Company

Considering the amount of business to be done, the advantage of having the invention properly made, and under the close supervision of the inventor, a manufacturing plant should be provided for—special machinery designed and improved ways of making in quantity adopted. The company to meet these conditions, ought to be, at least, a million dollar corporation named after the inventor.

Provision must be made to increase the capital within a year or so, and land acquired that will admit of increasing the plant to four times the size of the one at present under consideration. A friend of the inventor (oftentimes a relative) is to be the treasurer. He himself will assume the arduous duties of president, general manager, and all the other offices the law will permit and at the same time carry on a series of experiments to develop some embryonic ideas that will further enrich the company.

It is necessary to get the company started at once as money is needed to take care of the patent proceedings. The inventor has spent all of his, often his wife's also, and has loans to meet which the lender will not renew again unless he can seen some prospect of their being met and the back interest paid. "There will be no trouble on this latter score as soon as he sees I have the company going."

### Dollars Wanted

Judging from the inventor's almost flippant way of speaking of the money needed in his company, in comparison to the invention, it would seem to be a most insignificant detail, yet it is very evident that the value of the invention very quickly yields itself to that medium of expression, dollars. The worth of the inventor to the company also readily adapts itself to the dollar standard.

There seems to be a decided difference, in the mind of the inventor, between the value of the dollar he invites to come in and the values of those that represent his invention and himself. The former must at once become subservient to the latter. Fifty-one per cent. of the capital stock is to be turned over to the inventor for his invention, leaving the outsider as a silent, very silent partner, yet with a "glorious opportunity" of sharing the earnings of the invention minus a goodly salary to the inventor. The treasurer, a true, tried and honest friend of the inventor, a stranger to the outsider, is a further protection of the inventor's interest.

It looks very much as though the inventor had contrived to circumvent the

old saying, "You cannot have your cake and eat it too." The company owns the inventor's invention, and the inventor controls the company, while the outsider's dollars make it all possible.

### The Outsider's Dollars

Questioning this unequal standing between the dollars "on the outside looking in" by invitation of the inventor, and those would-be dollars "on the inside looking out," brings the answer from the inventor, "I have devoted five years (time varies with different men), days and nights to this invention, five years taken right out of my life." This is quite a slice out of a man's life spent exclusively on one thing, but when the parallel is drawn and comparisons made, the aspect changes. Five years against 25 years or so spent by the outsider, days and nights, devoted to getting a small fraction of the amount wanted by the inventor, who asks for the loan of this real money to help make his invention of actual worth, these same dollars sharing little but the risks, while the outsider has no opportunity of directing the policy of the company unless the inventor is willing to allow that privilege.

Until the invention has proved that it is a success, every dollar put in the company gives a value to the inventor's stock, while that of the outsider immediately shrinks in the same proportion. This may be overcome, in time, by the success of the invention or else lost entirely.

That is the invitation issued by the inventor to get in on the ground floor of one of "the greatest inventions since the Bell telephone." This Bell telephone example is used by 99 out of every 100 inventors, and would be by the remaining one were he not forestalled.

### Managing the Dollars

Further questioning brings out the fact that the treasurer is without previous experience in that capacity, but "that makes no difference whatever," according to the inventor, who, though without training himself, is going to keep his eye on the financial end along with his other duties. The combination when taken as a whole does not appeal very strongly to the outsider, when the inventor's past experience and future plans are reviewed. Having admitted that his personal money affairs are almost hopelessly involved with debts contracted on the possibility of the success of the invention; extravagant ideas of buying land for a manufacturing plant several times larger than needed; getting special machines made on the strength of one model, and the general attitude toward the outsider's dollars as most insignificant—their mission being only to aid him with *his* invention—all these things taken together are anything but encouraging to the outsider.

Throughout all this it is plain to be seen that there is an underlying distrust of the outsider, *his* honesty and good intentions. The precautions taken to protect himself at the expense of the man with the money, even though he asserts with so much force that he is the personification of uprightness only reflects on himself. The picture of this method of handling the dollars does not inspire confidence.

### Getting the Wrong Man

Fair and broad-minded men are not inclined to take up with propositions of this kind, though they may have a great deal of faith in the invention. This generally forces the inventor, not willing to change his ideas, to take up with anyone he can get and thus becomes the victim of scheming, designing, unscrupulous men. Herein lies the foundation of so many stories of inventors losing the reward of their inventions. The very things they fought so hard to prevent are brought out by their own precaution to guard themselves beyond the point of fairness to the outsider.

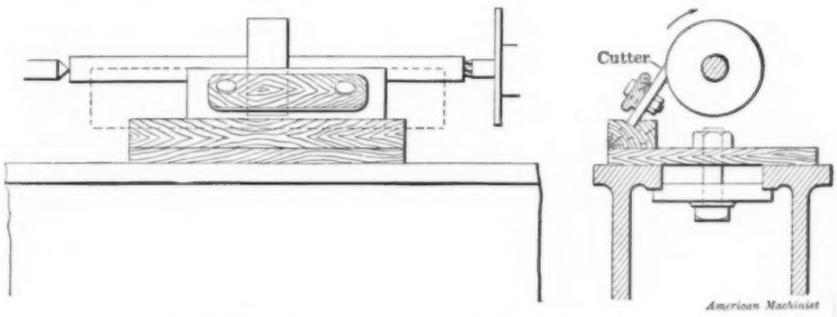
It is a well recognized fact that the world owes much to the genius of the inventor, and many of them have reaped the reward due them, while others have been much less fortunate. The inventor is apt to blame the world for this, but as there are many sides to every question let him stop a moment and consider the outsider's point of view, his rights and ideas. By so doing, he will generally find it much easier to get the capital needed and assure himself as well as the outsiders of the profits due each in the invention's advancement, thereby bringing about a harmonious condition.

# Sharpening Cutters for Wood Planers, Etc. *By Roy M. Senyour*

The sharpening of cutters for woodworking machines is often a laborious task and the patternmaker will welcome any time or labor saver in this line.

The sketch shows an arrangement adapted to a wood-turning lathe by which cutters can be ground uniformly hollow. For convenience in handling, the cutter is bolted to a wooden holder and a rest for the blade to slide along is constructed either as shown or may be connected to the existing tool carrier. This is fixed at the back of the machine unless the direction of rotation can be reversed.

The grinder is a wooden collar, say 5 inches diameter and 2 inches wide, mounted on a spindle which should be long enough to allow the cutter to slide the full length on it. After truing up cover the surface of the collar with thin glue and sprinkle powdered emery evenly over it. The grinding is done dry at a fair speed, care being taken not to burn the blades. The finishing edge is obtained on the oilstone.




Rig for Grinding Planer Knives on a Lathe

By using different shapes of grinders, with suitable rests, gouges and other tools can be sharpened rapidly. The cost of the apparatus being insignificant, will make it appeal to small shops unable to buy an expensive grinder.

## Testing Lubricating Oils

A simple test to ascertain the value of lubricating oils under service conditions, according to a paper presented to the American Society for Testing Materials, is to heat the oils to a temperature of 450 degrees Fahrenheit. At this temperature oils of an inferior nature showed a decided darkening of color, while those giving satisfactory results appeared to undergo very little change in that respect. Another test for engine-cylinder oil is to heat it for six hours at a temperature of 400 degrees Fahrenheit. After allowing for that which escapes with the steam the percentage of oil available for lubricating can be obtained.

# Tangye's Museum of the Watt Epoch-making Developments

*Famous Letters and Drawings of Great Engineering Interest*

By I. W. Chubb

When 15 years or so ago the firm of Boulton & Watt, Soho, near Birmingham, England, was sold, there was danger that many of the relics of James Watt, Matthew Boulton, and the eminent men connected with and following them might be dispersed or destroyed. They had been collected for a number of years from old drawers and other out of the way places by the late W. H. Darlington, who was for 20 years or more manager of the concern, assisted by his son, Seymour N. Darlington, for 10 years or so. As a small matter of mechanical engineering history it may be mentioned that the trustees, recognizing that the collection was due to the initiative of the elder Mr. Darlington, left the disposal of the room practically in his hands. In the nick of time the museum contents were sold for £500 to George Tangye, of the well known Birmingham firm. The large number of documents and so on have now once again been stored with care in a special room which is, in fact, part of the building in which the firm of Tangyes, Ltd., manufacture their machine tools. It is on the opposite side of the road from the main Cornwall works which are devoted to engines, pumps, etc. It is understood that eventually the contents will be given to the City of Birmingham.

A few appliances are included and a number of old pamphlets on engineering affairs etc., but for the most part the relics take the form of letters and drawings, and while both are of technical interest and value, the letters constitute a set of documents invaluable to the student not only of early engineering, but also of the character of Watt, his associates and successors. Three views of the Tangye Watt Museum are given in Figs. 1 to 3, the first two being side views, left- and right-hand respectively, while the other shows the end, with the door that is so strictly guarded. Down one side will be seen busts respectively of W. Murdock, Watt, G. Stephenson, R. Stephenson, Sir William Fairbairn, James Penn, with Watt and Murdock again at the end. Most of the letters are docketed and stored in drawers with sliding panels to keep out dust. The drawings are treated in much the same way and kept in portfolios, except that in some cases they are fixed in wall cases. The books, too, are numbered and arranged as shown in Figs. 2 and 3, and in the cupboards. It is, perhaps, not quite true that all these documents have been examined and indexed. This will be understood when it is stated that, including reverse copies, the drawings above are estimated to number between 36,000 and 40,000.

FIG. 1. LEFT-HAND SIDE OF WATT MUSEUM

### DRAWINGS

The drawings range over practically the whole of at least the earlier activities of the Boulton & Watt firm, being mostly confined, however, to the end of the 18th century. The first one handled by the writer, for instance, shows a plan of an engine and boiler for Coalbrookdale, dated June, 1781—Coalbrookdale where Newcomen pumping engines had for some years previous been manufactured. In most cases the draftsmanship is certainly more patient than is allowable under present competitive conditions. The drawings are nearly all in a remarkable state of preservation, with lines and colors apparently as distinct in many instances as when the drawings were first made. This, of course, is not always the case. The next drawing handled, dated 1778, had the paper fretting away. The drawing shows the Bow engine, 1775, with Watt's own handwriting, the engine of which the completion was urged by Boulton in order for one thing to disprove the assertion of the London Society of Enginers that the necessary tools and skill were not available for its manufacture. Another drawing shows a pump designed by Smeaton and made by Boulton & Watt, the drawing being entitled "Elevation of the great Engine for the 5th arch of London bridge, March, 1787." Smeaton, it will be recalled, designed the pump to be worked by the rise and fall of the tide for the City of London water supply. In many cases the drawings have been mounted. A legend on the back of one of the drawings "Working gear for Soho, 1795," is not altogether unfamiliar, namely, "This drawing is the property of Boulton & Watt, who beg that it may be kept clean, not permitted to be copied, and returned to them as soon as the engine is finished."

A pencil drawing by one of the younger Hornblowers apparently given to W. Murdock, may be handled. A parallel motion for a rolling-mill engine is shown under date, 1792, and a windmill used in Holland in 1800. Plans of the Soho mint, 1788, can also be seen, and others, made about 1799, for the equipment of a mint in Russia. From the Soho mint Boulton supplied the British copper coinage from 1797 for about 10 years, and at one time or another was connected with the mints of India, Russia, Spain, Denmark and Mexico.

### Description of Robert Fulton's Steamboat

A portfolio of drawings can also be seen with a description of the steamboat invention of Robert Fulton, dated January 1, 1809. It is uncertain whether all the drawings were by Fulton himself, though this is thought to be the case, and Andrew Carnegie, in his book on Watt in the Famous Scots Series, has stated that Fulton ordered an engine from his own drawings on August 6, 1803, and repeated the order personally in 1804. Anyway, the stern wheel, paddle and

Fig. 2. Right-hand Side of Watt Museum

Fig. 3. End of Museum

floating stage are shown, the drawnigs being signed by R. Fulton, August 6, 1803, and July 8, 1804, and the firm made the engine according to these drawings. America received it in 1805 and two years later it was placed in the "Clermont" on the Hudson river.

### Letters

It is possible, however, that the letters to be seen are of even greater interest. In the first letter book of the firm, dated 1775, a letter by Watt is included addressed to Sir Harbord Harbord, August 4, suggesting that "If good elm or other wooden pipes can be procured that will stand 60-ft. head of water at 3-in. bore, the pipes from the engine to the office may be of that material." Resting at the side is a section of elm received by Tangyes under date April 21, 1902, from the East London Waterworks Company (now absorbed in the Metropolitan Water Board), whose engineer says: "I have sent by London & Northwestern Railway a piece of an elm pipe taken up in the East End of London. These pipes were put down to enable the 'fire engine' made by Messrs. Boulton & Watt, somewhere about the year 1770, to pump into the district. A great many miles of other wooden pipes were also used by the company, the motive power being the water wheels and tidal wheels at Stratford."

Commercial men in engineering firms may be interested to read one of the letters sent out by Boulton & Watt, dated Soho, 15 Jan., 1870, as a request for payment:

Messrs. ————

Being in want of money at this time, have taken the liberty of sending your account for engine materials, as above amounted to 72-4-¾. Your sending us a remittance for the amount will oblige,

(*Signed*) J. Pearson.

The said J. Pearson appears at that time to have been an office boy. A little later, when letters were copied in the press, he had become an accountant.

### Letter to Abbé de Calonne

Another interesting document shown to the writer was a letter written by Watt on behalf of the firm to the Abbé de Calonne. R. H. Kirton has suggested that he was the brother of C. A. de Calonne, the controller general of France, the man who, according to the books, by his financial methods did more than most people to precipitate the French Revolution. However, in 1786 he concluded a commercial treaty with England which led greatly to the increase of French imports into Britain. Moreover, after his dismissal in April, 1787, he fled to England. The letter was not written direct to the minister owing to Watt's inability to express himself in French. It is dated Birmingham, February 10, 1787, some two months before the fall of de Calonne. Watt, it will be remembered, had been to France in 1786 to consult with the existing government regarding the receipt of the firm's machinery; in fact, Boulton & Watt brought back P. Droz and his split collar for coining, subsequently abandoned. To return, the letter is 11 pages long and cannot be quoted at full length. In it, toward the end, however, Watt enunciates some truths regarding national jealousies and fiscal matters which, even in our own days, seem to get obscured or forgotten.

*Letter of James Watt to Abbé de Calonne on behalf of Boulton & Watt*

Feb. 10, 1787.

"Everybody of observation here speaks with admiration and applause of the regulations which Mr. le Controleur-General means to propose to the assembly of the notables, and express a wish that our ministry would follow the same great line in simplifying our taxes . . . . but that part of our patriots who are not over-liberal fear that he will by freeing your commerce and agriculture from its shackles, make France too rich and too great for the welfare of Britain and its trade. We argue otherwise for we say that if these measures contribute to increase your manufactures or commerce, that our government will be *obliged* to lay aside the erroneous part of their system, and free our manufacturers from their grievances, and that the richer France becomes, the better customer she can be to Britain, and that at the worst, if no change of system is adopted here and our trade becomes ruined by the agrandisement of yours, that you will have made France so desirable a country that all active men who are not rooted to the soil like so many vegetables, will remove thither and help to make it still greater, leaving our tyrannical landholders to pay the national debt, to eat their own corn, and muddle their own understanding with their own ale, without one enlivening drop of burgundy except what the wool of their sheep can purchase. We hope, however, that both nations will be wise enough to profit by each others' good examples and to pursue them without each others' follies, and that both will have reason to rejoice in the benefits of the commerce produced by the present treaty, which so many at present oppose in this country.

"Mons. de'Calonne did us the honour to say at our last [Memo. Two lines missing here. Conjectured that matter runs 'over last interview . . . . If their'] minister is so too; there will be perpetual peace between 'France and England, and no nation in Europe will dare to go to war with another.' We repeated these words to Mr. Pitt, to which he answered 'that would be a most desirable and most glorious thing *if* such are their real sentiments.' You see, they both rest on the *'if.'* In my opinion they were both sincere, but which of them can answer for a change of sentiment from future contingencies, or for the actions of their successors? In the meantime they are in the right road, and I believe both nations most sincerely join them in praying for the said perpetual peace; but our countrymen fear yours are not sincere, and probably yours have the same fears; a continuance of peace and social intercourse will in the end remove these jealousies. In the meantime, let us use our endeavors within the small circle we revolve in to rub off some of the asperities.

"I send you a small treatise on the subject of taxation which I composed about two months ago, in a fit of rage at the imposition of several new taxes on manufactures; but which I have reason to believe was productive of no good effects, so infatuated is our government in using their endeavours to kill the hen which lays the golden eggs, and so tenaceous are our landed gentlemen *of what they call property,* reckoning us poor mechanics no better than the slaves who cultivate their vineyards; fortunately, however, they live in a country and age . . . . [missing] live without you, but you cannot have your luxuries without our help.

"When I look back on the state of intoxication in which we were kept at Paris by the very flattering civilities and attentions and unmerited praises we received and the good wine we drank, I fear we were guilty of many rudenesses and incivilities, and said and did many improper things. If, therefore, you feel we have done so in your presence, or towards you, we entreat you to forgive us, to believe they proceeded from no want of regard or respect to those who honoured us with their company, and to make our excuse to any we may have offended."

Watt apparently is never afraid to write, or to mention, his dyspeptic headaches. On the other hand, letters in the collection show that John Rennie seldom wrote long letters. He was employed by the Soho firm and worked at the grinding details of the Albion flour mills, Southwark, where the firm put in the first parallel-motion, sun and planet engine in London, in 1786. Letters from the hand of Thomas Telford are also all short. The handwriting of the "princely Boulton" is notable on the surface for straightness of writing. Smeaton, who years earlier, was critical of the Watt engines, addresses Watt as "my dear friend," under date, 1784. Other letters are from Professor Black, Priestly, 1784; Josiah Wedgwood (associated with Boulton in opposition to proposed taxes on iron, copper, etc.), and "your humble servant" Lord Dartmouth (who offered to show the firm's copying presses to George III); while under date Goodwood, October 10, 1784, referring to these appliances, the Duke of Richmond writes, after the manner of the advertisement testimonial, "I find your copying press so very useful that I must desire you to send me another of them with all the apparatus compleat. This to be with iron rollers of the small or common size, etc."

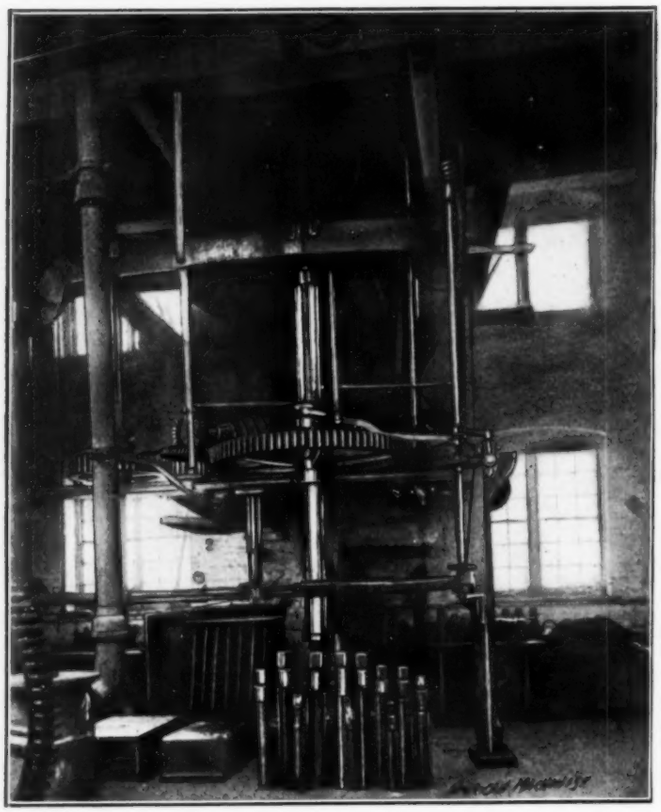


FIG. 4. VERTICAL TAPPING MACHINE

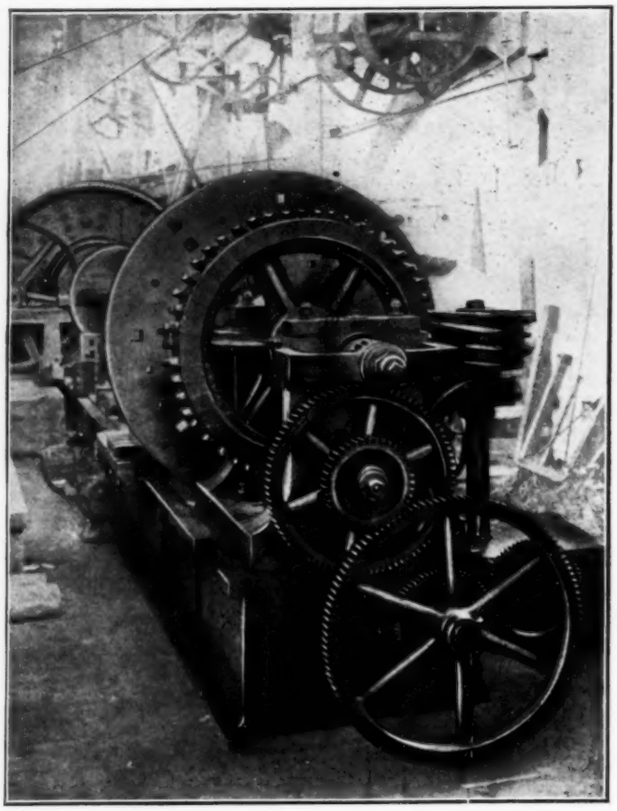


FIG. 5. WORM-DRIVEN LATHE

AN EXAMPLE OF WATT'S STYLE

As a sample of Watt's style we attach a letter dated Bedworth, February 28, 1777. Old Jonathan is apparently Jonathan Hornblower, son of Joseph Hornblower, and Doctor Dodd is William Dodd, clergyman and author, who, forging a bond for £4200 was hanged as punishment in 1777.

"Bedworth, February 28th, 1777.

"Dear sir:—

"It is now clearly determined that Behemoth neither has nor shall stir his tail in the month of February, 1777. Some engineers talk of putting in steam to try the joints tomorrow. If they do they must be busy. If they wait till the Lord's day and have his assistance I don't know what

they may do, but you need not think of coming, bringing nor sending anybody here until I bid you, otherwise you will only see a standing engine.

"Old Jonathan is to make their engine to use only 7 tons of coals per 24 hours, if so our own gains will be moderate. Your late attorney here, Mr. D—y has, it seems been much worse than Doctor Dodd. Many bonds of his fabrication, names and all have appeared, and yet the rogue was worth nothing, so much for high living. It will be necessary instantly to provide good piston rod iron, we immediately want several small ones. What appears to me best is immediately to write to Cleobury forge to draw some of their very best tough into eight square bars of the following sizes: 2 bars 6 feet long each 2½ diameter, for Chacewater; 4 bars 6 feet long each 2 diameter, Shadwell & Soho; 4 bars 6 feet long each 1¾ diameter; 8 bars 6 feet long each 1½ square or eight square, for sundries.

"Let the iron be got with all expedition, and I shall so soon as I come gloriously home contrive the means of manufacture.

"If now possible for you to, bring the ladies with you as the ground has got dry, if it keeps so, and I shall try to get an 18-oared barge laid at Longford against the day of the firey trial. On consideration I still think that we should erect young Chacewater for surely the owners will not be such fools as to throw away a new engine which has cost them £1000, and if they should, if they use the engine a twelve month we should get near £300 by it. I think comparing it with York buildings second engine which is nearly of the same power and uses 4 or 5 bushels per hour—I believe the latter quantity—that we should get 1s. per going hour or thereabouts. It is impossible for me to do anything in the drawing way here for setting aside that I have no place but the parlor where the ladies always are—I come home commonly after 4 or 5 o'clock without my dinner, which I then eat heartily and immediately after get heavy legs which you know to be a certain consequence of cramming oneself yet who can resist when hungry, and good meat and drink in the way. I expect to hear from you tomorrow before I send this off."

### Other Documents

Scores of indentures, certificates and articles of agreement dated from 1779 and onward are to be seen, together with prospectuses, patents, one or more with seals in tin cases, old Acts of Parliament, portraits of old engineers, dies and seals used by Boulton, Watt and Rennie, coins, a case containing drawing appliances, rules, memoranda and so on. For instance, there is a memorandum of agreement between James Constant Perrier and Boulton & Watt for the Paris Waterworks, February 12, 1779. Two years or so before this, according to the story, attempts had been made to get Watt's workmen over to France to divulge the engine secret. Letters from Gregory Watt, the son, may be seen; also an indenture between J. Watt, as mathematical instrument maker to the University of Glasgow, and John McLean, journeyman turner to Watt, dated Glasgow, July 14, 1761, in which McLean binds himself to Watt, being discharged in 1766. Documents give calculations respecting the saving of coal in Cornwall by the new Watt engine. In one case, for instance, the old engine consumed in two years 3100 tons at 10s., costing £1550. The new engine took 2039 tons at 10s., costing £1019 10s., which together with a premium for the use of the engine amounting to £303 19s., bill from Soho for £42, and tallow and hemp for two years at £60, totalled £1425 9s. and does not leave a very wide margin of profit for the mine owners, who paid for the engine also. It will be noted that in this case at least the premium was not at the usual rate of one-third the saving in coal consumed.

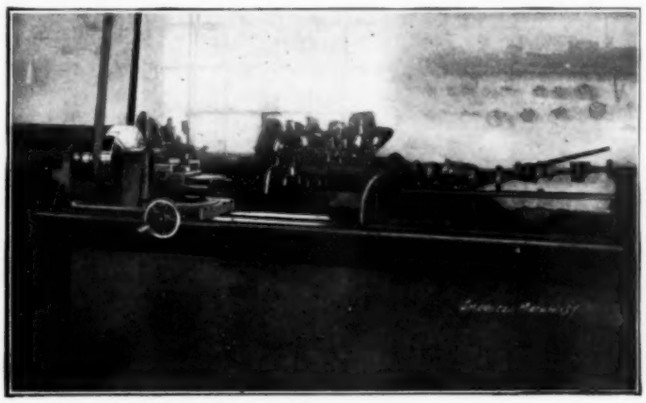


Fig. 6. Small Lathe

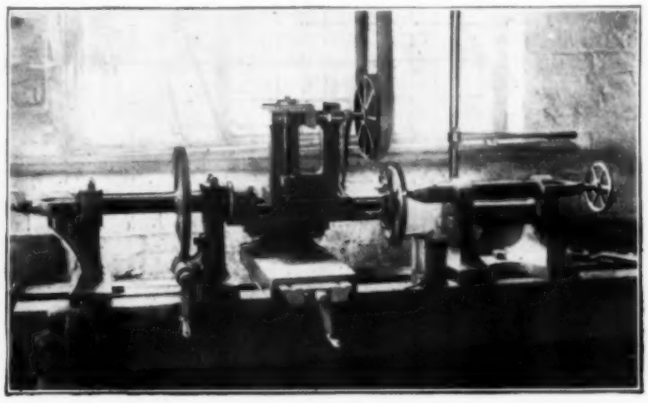


Fig. 7. Lathe and Milling Machine

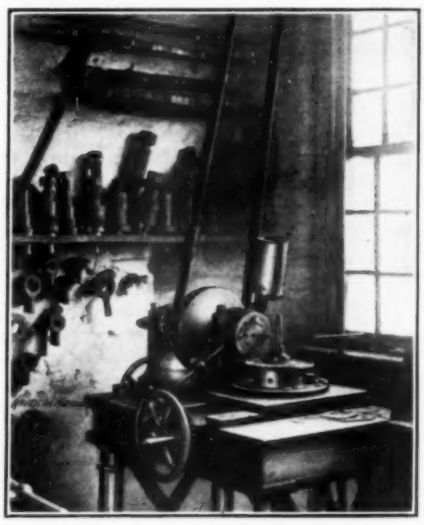


Fig. 8. Milling Machine

Another paper relates to the salary of the indispensable Murdock. In 1780, getting 20s. a week, he unsuccessfully applied for a "rise" to 42s. In 1810, however, his salary is £300, with a commission amounting to £317 10s., while for his gas lighting apparatus he received £66 10s. or a total of £684. Concerning his gas inventions, it is reported that Murdock was at one time invited out to dinner in Manchester with Sir William Fairbairn. The two being fog-bound, Murdock surprised his companion by stopping and apparently lighting himself to show the way. Unknown he was carrying a bag of gas. Murdock's own house now stands, but in bad condition. Also Watt's indicator book with diagrams dating back to 1803 is to be seen, the diagrams being out of order of date, however. The well known diary of the weather from the years 1805 to 1818 may be just mentioned. The barometer was taken at 8 in the morning, at 2 in the afternoon and at 8 in the evening. Temperatures were also recorded, and directions of wind and statements of the general condition of the weather were added, together with any natural history records—such as hearing the cuckoo, with a sketch of the bird itself.

A further note will suggest that human nature does not change greatly, for in the petty cash book of 1795 an entry is made relating to 2s. for beer allowed to men loading bricks. Among miscellaneous items may be added, reference to wages

books of 1826 and onward, and balanced housekeeping accounts of James Watt, Junior, at Aston Hall on the other side of Birmingham.

Bare mention may be made of the patent sounding machine or log, invented by E. Massey, and the leather basket, also to be seen in Fig. 2, used by James Watt for bringing his lunch from Heathfield. Again there is the three-cornered leather-cushioned arm-chair, Watt's office chair, in which royalties have seized the opportunity to sit. Guns for the corps of volunteers raised in Soho, 1798, are also an exhibit.

### Pamphlet of Jonathan Hull

Another interesting object is an engraving with letter-press of Jonathan Hull's invention, with letters patent 1737. His pamphlet, "A description and draught of a newly invented machine for carrying vessels or ships out of or into any harbor, port or river against wind or tide in a calm" contains the following: "There is one great hardship lies too commonly upon those, who propose to advise some new, though useful scheme for the public benefit. The world abounding more in rash censure, than in the candid and unprejudiced estimate of things, if a person does not answer their expectations in every point, instead of friendly treatment for his good intentions, he too often meets with ridicule and contempt.

"But I hope this will not be my case but that they will form a judgment of my present undertaking only from trial.

"If it should be said that I have filled this Tract with things that are foreign to the matter proposed, I answer that there is nothing in it but what is necessary to be understood by those that desire to know the nature of that which I now offer to the world. And I hope that through the blessing of God it may prove serviceable to my country."

### Photographs of Old Machine Tools

Obviously, but a comparatively few appliances and certainly no machine tools are included in the museum. The firm in the early days naturally had very few tools. Some of Watt's own personal belongings of this kind may, of course, be seen by the fortunate in the garret workshop at Heathfield. This is now, and has been since 1876 in the occupancy of George Tangye, who has always endeavored to preserve every memento of Watt. However, a number of photographs of old machines that were in use in the Boulton & Watt works may be inspected in the Watt Museum, and some are here reproduced. Fig. 4, for instance, shows a worm-driven lathe in the erecting shop which may perhaps correspond with the machine described in the sale catalog as "a 25-in. center, self-acting, sliding, surfacing and screwcutting lathe on a cast-iron bed, 26 ft. long, a pair of fast and loose headstocks, compound slide rest and saddle, worm driving gear, cast-iron driving plate 4-ft. diam." etc.

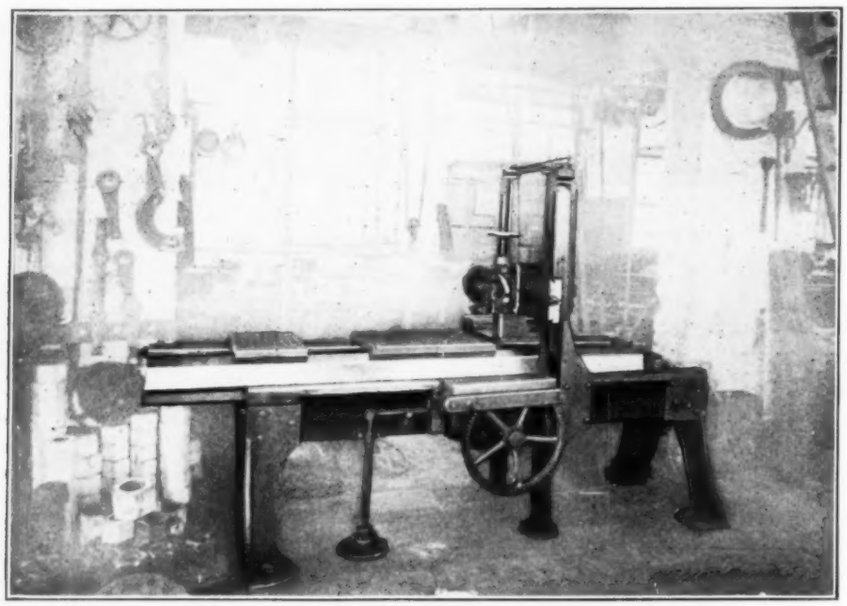


Fig. 9. Metal Planer

Fig. 5 shows what is usually regarded as a vertical tapping machine, a series of taps being underneath. On the other hand, Seymour Darlington, in the London *Engineer*, has suggested it to be a vertical boring machine. The drive was by means of cone pulleys and thence by bevel and spur gearing to the large wheel in which the bar slides. For the feed a rack will be noted on top. With this gears a pinion on a cross shaft, which is itself turned by wormwheel and worm, the latter being secured to the upper end of a long spindle which reaches down so as to be under control of the workman.

An old lathe of very simple type, and apparently with wooden bed on which are secured metal plates to take the slide rest, will be found in Fig. 6. The head and compound swiveling rest ask for no description.

The milling machine of lathe type illustrated in Fig. 7 supports the work on a mandrel or otherwise between centers, one spindle being hand-driven by worm and wormwheel. The milling cutter is driven from overhead by belt with bevel gearing, and horizontal motion of the cutter along the job is given by eccentric and ratchet gear, in an obvious manner. A small milling machine of the type which Nasmyth patented in 1829 is shown in Fig. 8. This was designed for milling, or cutting by circular file, as it was called, the hexagon nuts for a Maudslay model of a pair of 200-horsepower marine engines. The machine is essentially the same as that described and illustrated by Nasmyth in his specification, except as regards the "file." This, instead of having four inserted tools, was more of ordinary milling cutter form.

Finally, Fig. 9 gives a view of a light planing machine, of which, as Mr. Darlington has said, the chief feature is the use of a bed with vees on top to which plates for the work are fitted. The want of fuller and more authentic accounts of these and other Boulton & Watt tools is much to be regretted.

### Watt's Copying Press

In a paragraph we may deal with Watt's copying press. This he invented in 1778 and, keeping it secret for two years, obtained a patent in 1780. The opposition of bankers, who were afraid of forgery, the demonstrations by Boulton to the members of the Houses of Lords and Commons, and other incidents concerned with this invention will be found detailed in the pages of Smiles. The invention was eventually a great success both in England and on the continent; in fact, somewhat later, special instructions were got out in French, a pamphlet being published in 1807 entitled "Maniere de se Servir de la Machine à Copier inventée et patentée par Jacques Watt & Co." The collection includes the press which was used at the works; see Fig. 1. It will be recalled that in the first instance the letters were copied on single sheets which were pasted into a book. This machine was attached to the table and pressure was obtained from rollers, which were preferred to screws by Watt himself. Watt devised a portable copying press fixed in a box which is clamped to the table. According to the description then given by the firm of the contents, "The box opens in the middle, and presents the copying apparatus on one side, a secretary for containing papers, letters, pens, etc., on the other. The

copying apparatus consists (1) Of the press, with its two metallic rolls, which are put in motion by (2) The handle or lever, fitting upon the extremity of the axis of the upper roll. (3) Of the double pasteboard to be introduced between the rolls, answering the uses of the board in the larger machines, and covered with Fearnought cloth, for the purpose of elastic compression. A quarto sheet of writing paper folded up with copying paper and oiled paper interleaved, is placed between the pasteboards, to show the mode of copying four pages at a time. This being merely inclosed for the purpose of instruction, must be removed when you use the machine. The mode of copying one, two, or three pages, will be hence apparent, as you will only have to lay on fewer sheets of copying paper." It also contains a damping box, a measure for the quantity of water necessary for a given number of sheets, a wetting book, damping brush, drying book and the cramp. The secretary, in the upper part of the box, contained spare copying paper, writing paper, sponge papers "serving to smooth and dry the original from which you have taken a copy, by interleaving it with them, and repassing it through the press," spare interleaving oil papers, ink powders (the ink being Watt's invention) and space for wafers, pens, sealing wax, penknife, etc.

Henry Wright, of Small Heath, about 11 years ago stated that Watt applied his letter-copying machine, by enlargement, to the copying of drawings. The pencil drawing, being "gone over" with the ink, was damped on the back till the ink was shiny. Another sheet of damped drawing paper was placed on it, the two were passed through the rollers and a reverse copy was obtained. He stated that a large proportion of the 36,000 to 40,000 drawings were made in this manner and re-inked and colored if necessary for stock.

It would not be just to conclude this article without reference to the courtesy of the firm of Tangyes, Ltd., Birmingham, who allowed the writer the major part of a day in their Watt Museum, and supplied photographs, or without thanking Harold Baker, head of the machine-tool department, and R. W. Kirton, curator, for guidance to the contents of this unique and invaluable collection of epoch-making relics.

# Standardization vs. Grinding Principles

*By John R. Godfrey*

I wonder if other mechanics who call themselves rational human beings, because none of their friends have ever noticed anything queer about them, get mixed up about things as I do. Emerson's reflection on the fact that great men never can be consistent is a great comfort at times. My special mixup this time is standardizing.

Not long ago I visited two separate factories of a large concern, not so many miles apart, and the difference in the practices of these shops was astonishing. In one shop the feed for milling the same piece was almost double that used by the other shop. On the other hand, the shop which was slow in milling was ahead of the other shop on some other operations.

Here was surely a case for standards or an approach to them. There was no interchange of ideas between these shops so far as I could find out, but a blind man could see that this was exactly what was needed.

This is a case where shop visiting by those responsible for results would have paid large interest. And there is little doubt that any live man can get enough real information of one kind or another to repay his time and expenses while visiting other shops. Not that he is likely to find many things which he can use just as he finds them, but he will get ideas of many kinds that he can adapt for his needs in various ways.

Yet there is a danger in too much standardizing, and here is where my mixed-up feeling comes in.

Any reasonable man will be perfectly willing to speed his milling feed up to even an unheard-of point, if he can be convinced that it is the best thing to do in his case. The chances are that he will even go the other one better on the proposition. But it is an open question whether it is good policy to issue iron-clad orders regarding the exact feeds and speeds of every tool in the shop. Any attempt to take all responsibility away from any man opens grave dangers in the way of killing all incentive to initiative of any kind.

I recently heard a systematizer bewail the fact that all drilling-machine makers did not make their feed boxes exactly alike so he could issue orders to have 9/16-inch drills run in a certain notch and have it apply to all machines. While this seems reasonable enough from one point of view, I have never been able to educate myself to the belief that all the brains in any establishment were locked in the office, or that it was better to have a set of automatons in the shop, even on automatic machines.

One of the largest shops I know of, adopted the standard-tool idea, furnishing the correct shape for each job. And in spite of the work all being by the piece, the production fell off, the pay envelops had a leanness that was far from pleasing to the men, and they went back to the unscientific, but in their case highly productive, plan of letting each man grind his own tools just as he thought best.

Now, if there is any place where absolute standards ought to go, it is in the best shape of tool to remove metal with the least power, in the quickest time, etc., etc. But it didn't work in this case. And when you consider that it affected the pocket-book nerve of the men at the lathe, it seems a safe bet that there wasn't any faking about it.

So, while I am a great believer in standards for pipe threads and anything that must fit other commercial products, and while it seems reasonable to suppose that similar standards might be used for many other things, I cannot get away from the notion that it is not practical to lay down any hard and fast rules for many items that come up in every-day shop work. There are many guiding principles that it is well to know, but they must be applied with a good seasoning of horse sense, or they lead to strange results.

# Emergency Hospital for First Aid to the Injured

The Billings & Spencer Company, of Hartford, Conn., has recently added to its plant an emergency hospital for the treatment of first aid to the injured cases. Located in a corner of the machine department, it is easily accessible from all other departments of the factory, and all injuries, minor or serious, are ordered to report there for treatment.

The room erected for the purpose, 12x 20 feet, is finished throughout in white enamel. The outfit consists of an iron enameled bed; sterilizer for both instruments and dressings; cabinet for instruments, solutions and dressings; hot- and cold-water equipment; stretcher for transportation of serious cases from various departments; and other minor necessities.

The room is under the immediate supervision of chief clerk of the factory office, whose previous experience in hospital work fits him to have charge.

An injury sustained by an employee is immediately reported to the foreman of his department, who orders the case to the hospital for treatment, where it is taken care of. If the injury proves too serious, the injured is either ordered home for care by his own physician or to one of the city hospitals. A custom has been established, whereby all secondary dressings are ordered to report at 9 a.m. every day for inspection and advice.

# Automatic Machines Used in the Manufacture of Chain

*Novel Mechanisms and Devices for Ingenious Operations*

Special Correspondence

In the manufacture of small brass and gold chain for jewelry purposes, many interesting automatic machines are used. In the accompanying halftones are illustrated some machines which were made and are used in the manufacture of chain by the E. C. Bliss Manufacturing Company, of Providence, R. I. These machines receive brass, gold or gold-filled wire, fed to them from the reel and turn out at the other end, the completed chain with the links all formed and properly assembled. The length of chain made in a given time depends, of course, upon the size of the links, as the machines are rated to make so many links per minute, but of the average sizes made in this establishment, each machine makes from 100 to 300 yards of chain per day.

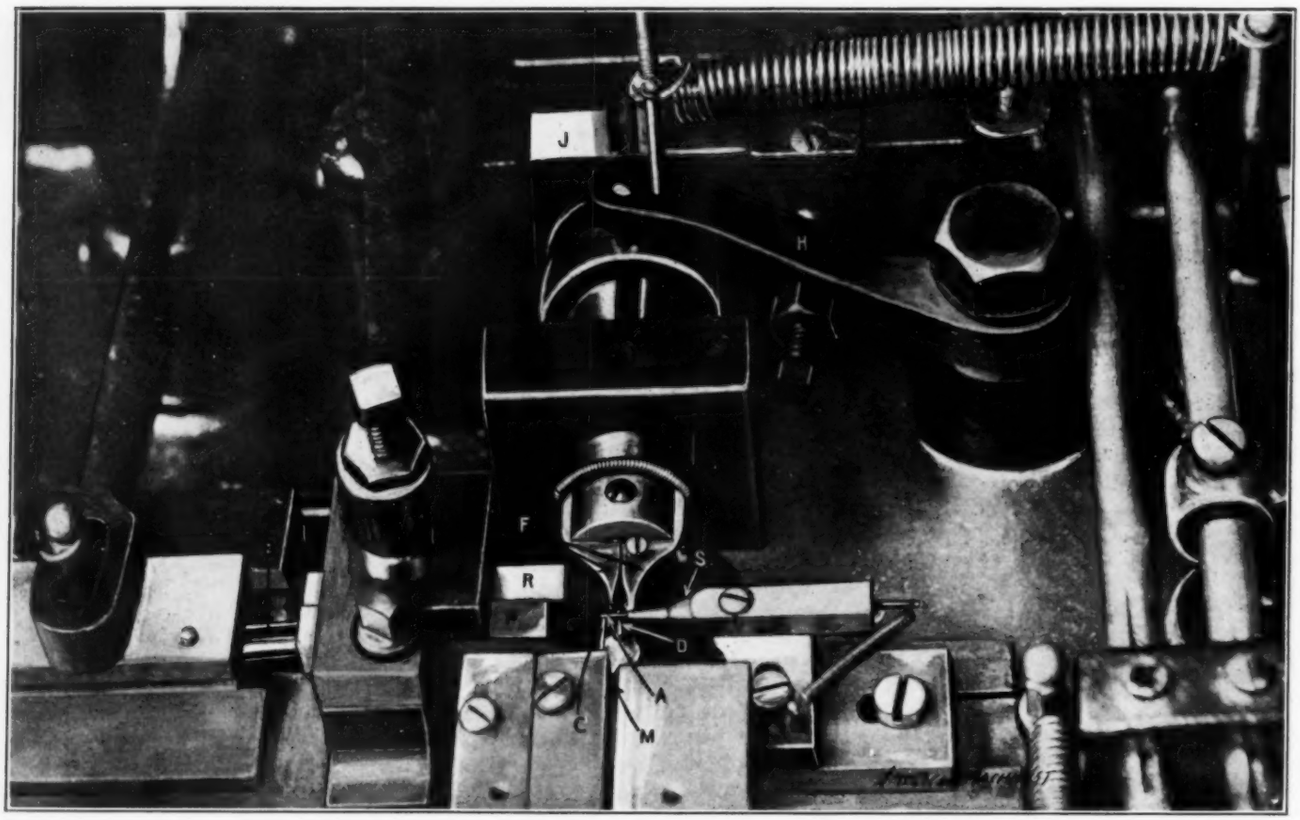



FIG. 1. MODERN PLAIN-LINK CHAIN MACHINE. FIRST STEP—WIRE THREADED THROUGH

In Figs. 1 and 2 is shown the most up-to-date type of chain-making machine producing ordinary chain with oval links. Referring to Fig. 1, *A* and *B* are two portion of the same piece of wire being fed in to form the links. At *A* the wire is just back of the arbor *D*, which is a pin so shaped that when the wire is bent around it the link will be of proper form. The head *G* is so operated by the lever arm *H* and the rack *J* that it will be thrust forward, closing its jaws *F* and will also rotate as shown in Fig. 2, finally opening its jaws again. The first step after the feeding of the wire *A*, is for the knife *C* to approach and cut off this wire just where it emerges from the gripping guides *P* and *R*. The swinging stop piece *S* determines the length of the wire which is fed forward by the feeding plate to the left of *B*. Just as the wire is cut off by the knife, the head *G* approaches and the jaws *F*, which are suitably grooved in their ends, push the short length of wire at *A* so that it is bent around each side of the arbor *D* in the shape of a horseshoe. While this wire is being pushed forward, the stop *S* swings about its center, which is indicated by the machine screw, so as to allow the wire to come forward. While the horseshoe-shaped piece of wire is being bent around the arbor, the closing piece *M* is pushed forward, drawing the open ends of the horseshoe together and forming the link smoothly and in the proper shape.

During all of this time the short piece of wire, which is now a link, is being firmly held by the jaws *F*, and at this point the arbor *D* is drawn out of the link while the head *G* rotates as in Fig. 2, turning the link up on edge. Just at this instant the feeding mechanism pushes the wire *B* forward between the guide pieces *R* and *P*, so as to thrust another length of wire *A* against the stop piece, and this length of wire passes through the link just formed, which is held on edge in the jaws *F*. At the next instant the jaws open, freeing the link, which then hangs from the projecting wire *A*; the head *G* turns back, so that the jaws are in a horizontal position again and come forward to bend the new piece of wire around the arbor *D* to form a new link. In this way a continuous chain is formed, which hangs down below the machine.

In the arbor *D*, on the far side, is a shallow, vertical groove, to take care of

the wire of the link previously made, when it is standing on edge, while the new link is being formed around *D*. In Fig. 2 the completed link *K* is shown in the jaws *F*, and below can be indistinctly seen, the links *L*, of the chain already formed.

### Hook Type of Chain Machine

In Figs. 3 and 4 is shown what is known as the hook type of chain machine. This is one of the older forms and is not so rapid as the one already described. Looking at Fig. 3, the brass or gold wire, *B A*, is fed through as before, coming against a suitable stop to measure off the length. As in the previous case, the jaws are *F F*. In this case, however, the jaws do not rotate, but simply thrust forward and open and close. They are also provided with slots on their ends, as shown in the halftone, these slots acting to guide the wire as it is wrapped around the arbor *D*. In order to accomplish this, as before, the knife *C* goes forward, cutting off the wire, the jaws *F* approach and bend the short length of wire around the arbor *D*, forming a horseshoe, while the closing piece *M* is pushed forward to close the ends into a link. In the case illustrated the arbor *D* is more oval than in Figs. 1 and 2, as the machine shown in Figs. 3 and 4 is making longer links than in the previous case.

It is after this first bending that the difference in operation between a hook machine and that first described takes place. After the link has been closed, the arbor *D* is quickly drawn down and at the same time the hook *E*, with a peculiar downward and sidewise motion, drops through the link and catches it by one edge, lifting it up as in Fig. 4. While held in this position, a new length of wire *A*, is threaded through this link just formed. After this, the jaws *F* again approach, bending the new piece of wire, which has been cut off by the knife *C* so as to form another link around the arbor, making a continuous operation and forming an unbroken chain. In Fig. 4 the suspended link is marked *K*, the closing piece *M* and all the other letters correspond to those shown in Figs. 1 and 2 for similar parts.

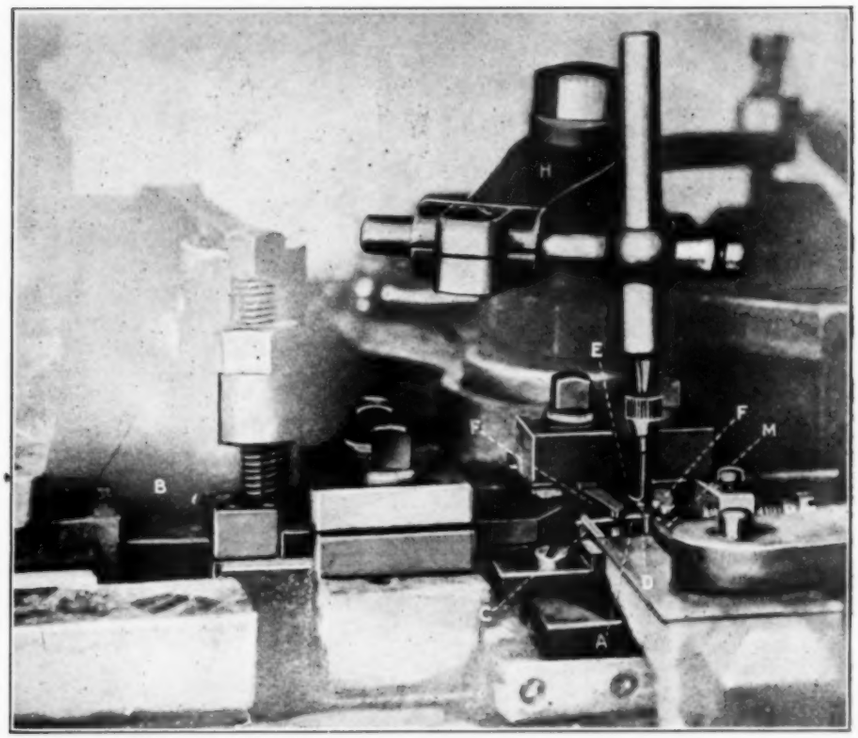



Fig. 3. Hook-type, Plain-link Chain Machine. First Step—Wire Threaded Through

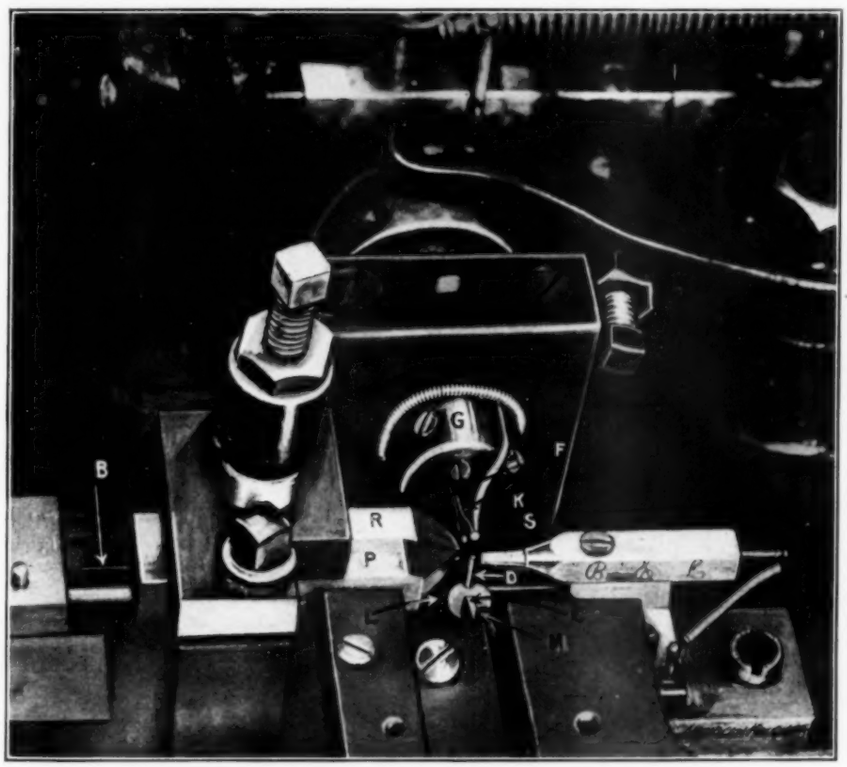



Fig. 2. Modern Plain-link Chain Machine. First Step—Wire Threaded Through

### Ladder Chain

In Figs. 5, 6 and 7 a very interesting machine making what is known as "ladder chain," is illustrated. A ladder chain is what is often used on cheap grades of jewelry as for holding ladies' fans and similar articles. Each link is composed of two loops at right angles. This may be illustrated by imagining a wire to be bent around into the shape of an open horseshoe and then the two ends bent upward and back, while being brought together parallel to each other.

As Fig. 7 illustrates the final step in the formation of a link, it also illustrates the first step. The letters in Figs. 5, 6 and 7 all correspond to the same parts. Referring to Fig. 7, it will be seen that the wire is threaded through the completed link *K*, which is held in the jaws *F*. Just after being threaded through, the jaws open, leaving the link just formed and bending the new piece of wire around the arbor *D*, it having, of course, been previously cut off by the knife *C*. In this case it will be seen that a much greater length of wire is involved in each link and this is because of the double loop nature of the link.

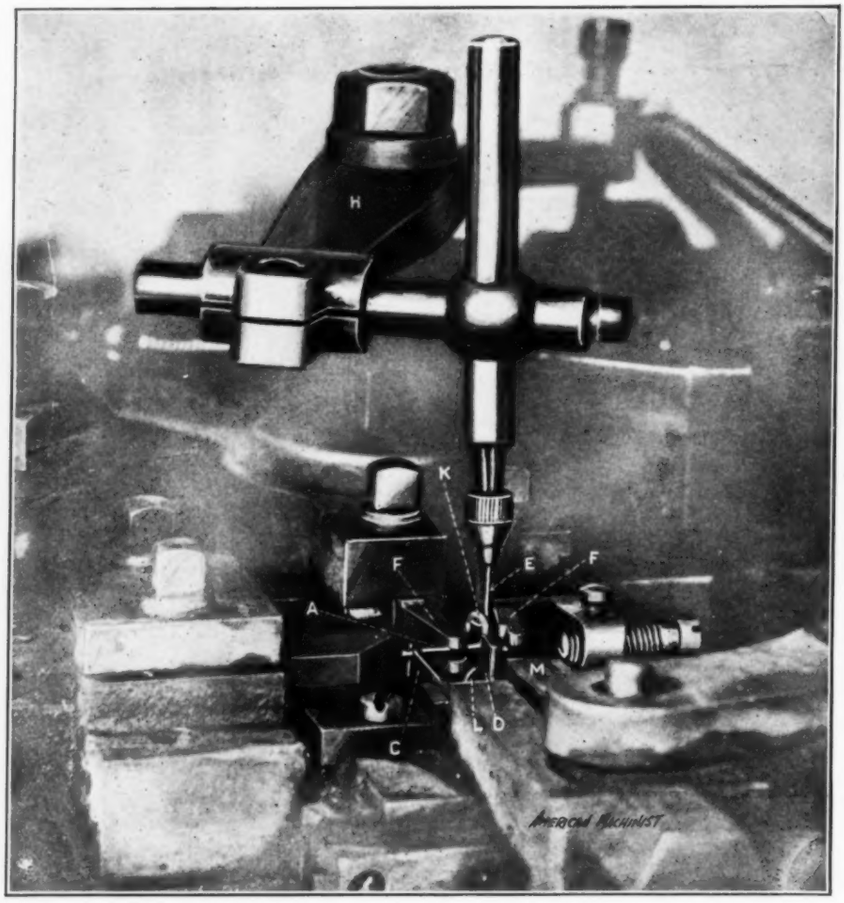



FIG. 4. HOOK-TYPE PLAIN-LINK CHAIN MACHINE. LAST STEP—LINK HOOKED UP TO RECEIVE WIRE

After being threaded through, cut off and bent forward, the next step is best illustrated by Fig. 5, where it is seen that the fingers *E* have pushed forward past the stop piece *S* and are bending up the ends of the link *K*. This is done by a rotation of the fingers *E*, which, while they rotate, also roll backward toward the center of the machine, thus following the wire right over as it bends.

Fig. 6 shows the link *K* bent a little further and the closing pieces *M M* approaching to complete the bend, one from above and the other from a horizontal direction. When the ends of the wire have been pushed down into place the condition shown in Fig. 7 then follows; that is, the link is completely closed, gripped by the jaws *F* and a new piece of wire *A* is threaded through it, ready to be formed into another link.

As seen from the illustrations, these machines are quite complicated and contain a large number of parts. The motions required are sometimes quite complex and these are produced by cams, in many cases two or more cams working to give the motion to a part in two or more directions at the same time. The operation is perfectly continuous, as already said, and the chains formed pass down underneath the machine, into revolving vessels where they coil around without tangling, ready to be taken out and cut off in lengths as desired.

For the formation of what is known as curbed chain, as is usual for watch chain,

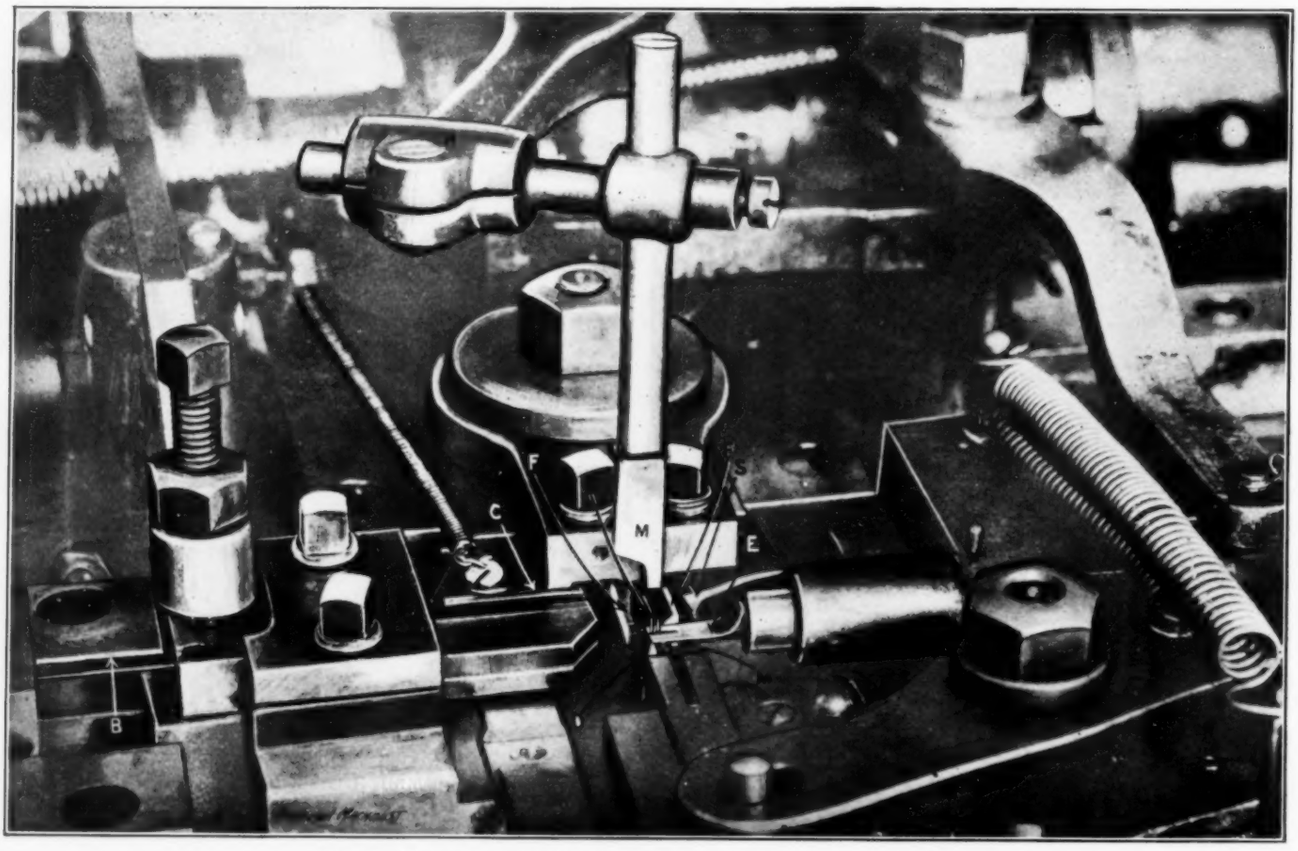



FIG. 5. "LADDER CHAIN" MACHINE BENDING UP THE LINK ENDS

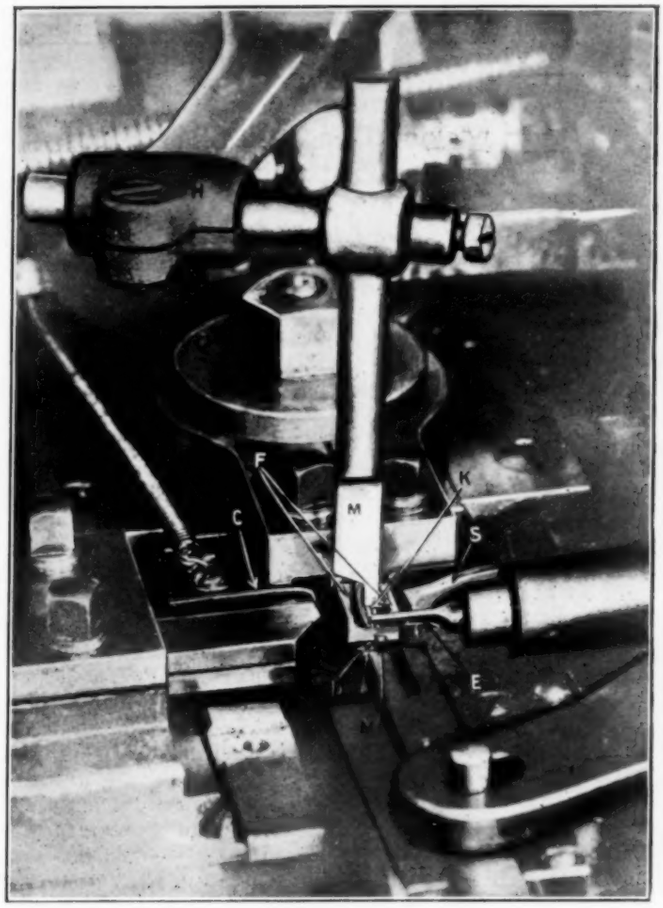



FIG. 6. "LADDER CHAIN" MACHINE; CLOSING LINK

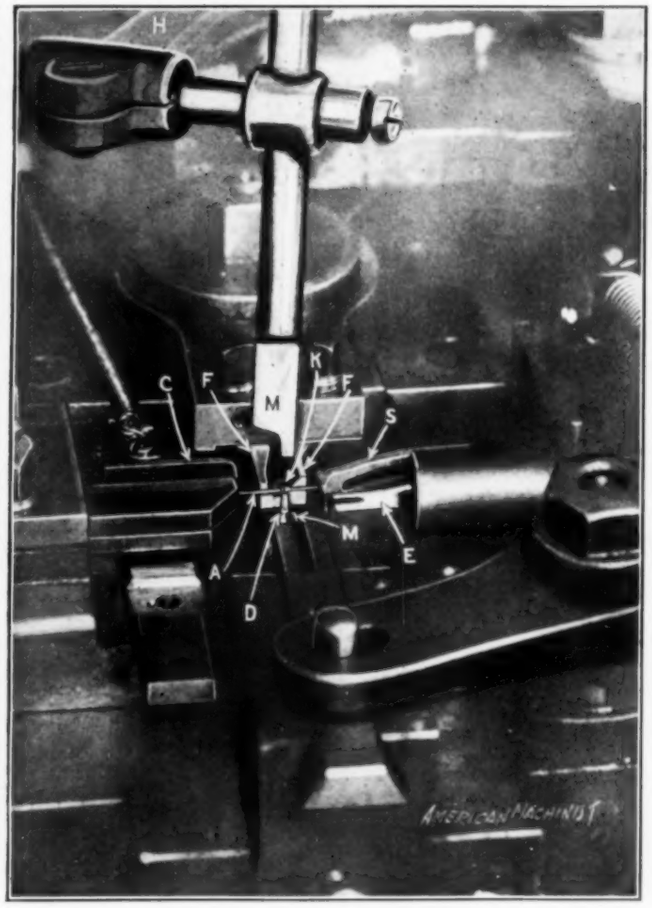



FIG. 7. "LADDER CHAIN" MACHINE; LINK ENDS CLOSED AND WIRE THREADED THROUGH

the ordinary oval link chain is passed through a curbing head where it is twisted and flattened to give the characteristic shape of an ordinary watch chain.

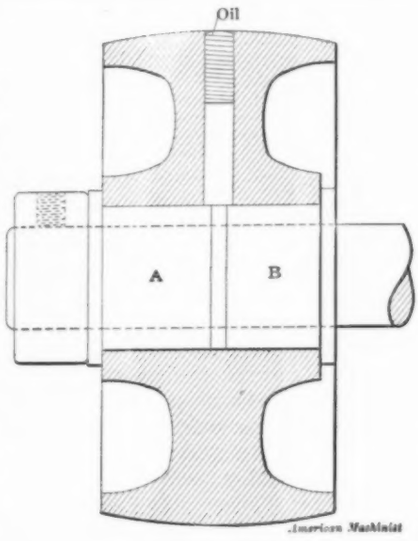
When it is desired to solder the gold chain links, this is done by hand, applying a flux and an almost infinitesimal piece of gold solder. This is fused by passing a fine-pointed, blue gas flame along the chain, the links of which are so arranged that the open parts of each two adjacent links come together. In this way the links are soldered together in pairs, with the openings together and closed by the solder.

# Bushing Loose Pulleys

*By Paul Campbell*

One of the frequent jobs that fall to the lot of the repair man is that of renewing the bushings in loose pulleys. Being regarded as a job not requiring a high order of skill they are generally given to the poorest lathe hand or the boys and as a result a loose pulley bushing, renewed by an inexperienced hand, while a simple job, is the cause of considerable loss and inconvenience.

It is the usual practice to make these bushings of brass and a tight fit in the pulley, and times without number I have seen pulley hubs cracked through the desire to make the bush tight enough, and the bushing hole reduced in size, making necessary another operation in reaming or scraping the hole to fit the shaft. The brass usually found around the shop is not of the right character for the use to which it is put and the slightest neglect in oiling starts it on its noisy way back.




BUSHINGS FOR LOOSE PULLEY

The line cut illustrates a method we have employed for some years and for simplicity and economy in construction and efficiency in operation has the tight bushing tied to a post and left behind. It has given complete satisfaction whenever used.

It consists of two flange bushings *A* and *B* of cast iron, bored and turned a running fit on the shaft and in the pulley, with oil grooves inside and out and an oil space in the center. We chuck a piece of cast iron, boring and turning in one operation, afterward cutting to length. In the case of long pulleys a third bush is used in the center. Space for the flanges is obtained by facing the pulley hubs where necessary.

This style of bushing is easier to make therefore cheaper, and will stand more abuse and neglect than the tight brass bushing and once used, you will not revert to the old method.

# Letters from Practical Men

Concerning the Details of Making Things in Machine Shops from the First Sketch to the Sale

## Inspection of Work

I have read the article recently published on the above subject and give the following experience for the benefit of readers. I have held the position of chief inspector for over five years, and half a dozen men whom I have tutored for this work now hold similar positions in different parts of this country. Although no particular system of inspection can be taken from one shop and applied to another without modification, yet the principles will apply in most cases.

Form 2300. 6 Bks. 11.04.

88

INSPECTION DEPT. Date, 11/3/05

DEFECT REPORT. 15 MAR Rec'd

| DESCRIPTION. | Size of Engine. | S.O.# | E.# | Qty. | DEFECT. | DECISION. |
|---|---|---|---|---|---|---|
| Gov Balls | a | 13844 | 3902 | 2 | milled ¼ out of | Pass |
| | | 39445 | | | center thus | |
| Secntre | a | 47558 | 1405 | 1 | shaped to finished size | Pass |
| bearing | | 36789 | | | before boring | |
| compress | | 47458 | | 1 | bad metal on end | Pass |
| casing cam | | 39931 | 629 | | | |
| Piston | a | 47420 | 2548 | 1 | bad metal | Scrap |
| Ring | | 38597 | | | | |
| wedges | a | 31554 | | 3 | wrongly marked off on | Scrap |
| for piston | | 39292 | | | taper side for shaping | |
| pin brasses | | #8 | | | small at one end | |

American Machinist

Signed,

FIG. 1. DEFECT REPORT (ACTUAL SIZE 5x8 INCHES)

I have invariably found that the isolation of the inspection department from the rest of the shop is necessary. Also the inspectors should have a separate set of gages, drawings, etc. For large work, of course, the inspector has to visit the machines to examine the work before it is disturbed.

### A GOOD INSPECTION SYSTEM NEEDED

In a certain work I was appointed to organize this department, as the firm had gotten into difficulties through a faulty system introduced by a man who had not had any practical experience. The firm had introduced the premium system some months before and the energies of the management had been concentrated on time setting and getting the system going. The shop had been working a loose system of piece work prior to the change, and it appeared by the results of the first six months operation of the premium system that the machining cost had been reduced to one-third of that under the piecework system. This was very gratifying, but the work did not circulate, due to the congestion at the inspection table. In fact, the machine foreman removed work from the table and passed it for other operations without inspection. When I commenced, I found they had four inspectors, men whose abilities were all that could be desired. They were crowded in among the machines and practically were without a home. Their tools were common to the shop, as were drawings, etc. There was sufficient work waiting inspection to stock a good sized workstore, and a stock of work tickets amounting roughly to 4000.

### INAUGURATION OF THE SYSTEM

My first move was to get a portion of the shop cleared and partitioned off from the remainder of the shop. I got micrometers, gages, spirit levels, squares, a cast-iron surface table, carrying centers for testing turned work, also a cabinet for drawings, and a large, wood work table to accommodate four inspectors. I had test bars made for testing the alinement of holes, also for testing if they were straight. I then drafted three of the inspectors into this department and had all work taken in here from this date, as it was finished ready for inspection.

As each workman had a work ticket for each job, he took the ticket to the ticket clerk to be stamped upon completion of his operation and received a new ticket for his next job. The inspector's laborer went every hour to the ticket clerk and received all the work tickets that had been handed in from his previous visits, and by the aid of these went round to the various machines and collected the work, taking it to the inspection department, where he laid the work with the work ticket on top. This work ticket gave all the necessary information to enable the inspector immediately to check the part and send it on to its next operation. I might add here that each inspector was furnished with two stamps, one, one-eighth diameter, and one, one-quarter inch diameter, and each inspector's stamps were different from his colleague's.

**INSPECTION CARD.**

Work Ticket No. ..... Quantity ..... Catalogue No. ..... Drawing No. .....

Description ..... Material ..... Engine Size .....

| Process | Quantity | Date | Defect Report | Inspector | Process | Quantity | Date | Defect Report | Inspector |
|---|---|---|---|---|---|---|---|---|---|
| Turning | | | | | Slot Drilling | | | | |
| Boring | | | | | Grinding | | | | |
| Planing | | | | | Reamering | | | | |
| Shaping | | | | | Hardening | | | | |
| Slotting | | | | | Tool Room | | | | |
| Milling | | | | | Smithy | | | | |
| Drilling | | | | | Erecting Shop | | | | |
| Marking off | | | | | Finished Stores | | | | |
| | | | | | | | | | |
| | | | | | | | | | |

Engine No. ..... Office Order ..... Signed .....

See Over.

American Machinist

FIG. 2. INSPECTION CARD (ACTUAL SIZE 3x5 INCHES)

### SOME DEFECTS NOT FOUND BEFORE

The man left outside was six weeks in clearing up the parts left by the others. He found several jobs but could find no tickets; in other cases (most frequent) finding tickets but no jobs. Now we were on a true basis, the first thing

noticeable was the amount of bad workmanship coming through. Holes out of alinement, planing and drilling not square with each other, etc. Up to this time they had had no proper means of testing these. The machine foreman had been with the firm a number of years and knew the parts from memory, so to speak. I pointed out the defective work to him and was as diplomatic as possible in the matter so as not to offend him. My opinion of what was good enough and his opinion differed very much, and I soon found that I should have to stand out for better production. After some consideration I decided to introduce a book for recording work that did not come up to gages and got out the "Defect Report Book," a copy of one of the pages being shown in Fig. 1. This book was in triplicate. The entries were submitted to the works manager daily, who decided upon the disposition of the defective parts and signed each report. One copy was then sent to the drawing office where they noted anything of interest to them, initialed the copy and sent it to the foreman fitter, who was then prepared for any parts coming along that would not be standard. The second copy was sent to the machine foreman, who was thereby notified of the quality of work turned out and also what parts would have to be replaced. The third copy was retained in the book. At first this book caused a sensation to the parties mentioned, but it fulfilled its mission. We got a higher standard of work and without friction.

### Graft in the Machine Shop

The next point was one more serious. The percentages of bonus earned by the men dropped considerably when the department got working. In fact, some jobs would not pay at all, which before had shown the full percentage of bonus earned. This appeared as though the inspection of the work had a tendency to reduce the output and I investigated several cases to satisfy myself if this were the case. I had to admit that there was some truth in one or two of the cases, but these were righted by giving the man better facilities for doing the work. The true solution came at stock-taking time. It was then found that the stores were carrying a considerable less stock than was recorded in the books. On further investigation it turned out that men had been paid times over for the same parts. They booked the parts in and laid the work by the inspectors' table. Next they took these parts back again to their machines to be booked a second time. The inspector signed his tickets under the impression that the machine foreman had sent the parts on to another operation. This was being done by several of the men and accounted for the apparent superiority of the premium over the piece-work system. The isolation of the inspectors and the collecting of the work by their laborer prevented this fraud from being carried on.

### An Inspection Card

I then decided to adopt an inspection card, as shown in Fig. 2, for preventing any job from being booked twice, also as a record of how any particular job stood, how many operations had been performed on it, etc. The inspector, on examining any work, signed this card for the operation he had inspected and put a mark opposite the operation to which he had sent the work. This proved most valuable as the condition of any order could be obtained by looking up these cards. The card also showed if any defective work was on any particular order. The same condition applied to the erection of work. If any parts did not come together correctly when assembling, due to workmanship or design, the case was entered in the report book and passed upon in the usual way. From these reports a complete log was made out against every engine, and when replace parts were ordered at any time they could be supplied correctly.

The defect book I now look upon as necessary to any inspection department, for it reduces friction to a minimum. It would prevent $50 shafts from being thrown on the scrap heap for half a thousandth error. It prevents any personal feeling being introduced and every part scrapped is done so by the management.

London, Eng. I. H. Treat.

## A Simple Gear Testing Rig for Hardened Gears

Figs. 1 and 2 show a gear-testing fixture designed by Mr. Lipe, of the Brown-Lipe Gear Company, Syracuse, N. Y., which for simplicity and efficiency is hard to beat. It consists of a base *A* of cast iron planed on the top and having two tongues *B*, one at each end in line with each other, all the planing on the piece being done at the one setting. The two pieces *C* are planed on the bottom with a groove in each fitting the tongues in the base They are then mounted in place on the base which has not been moved from its place on the planer table and after clamping securely, they are planed at the one setting. At the back

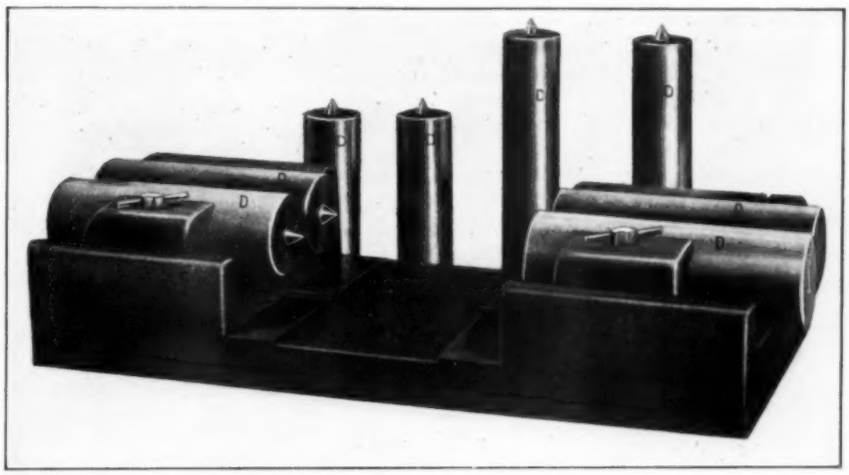


Fig. 1. A Gear-testing Rig

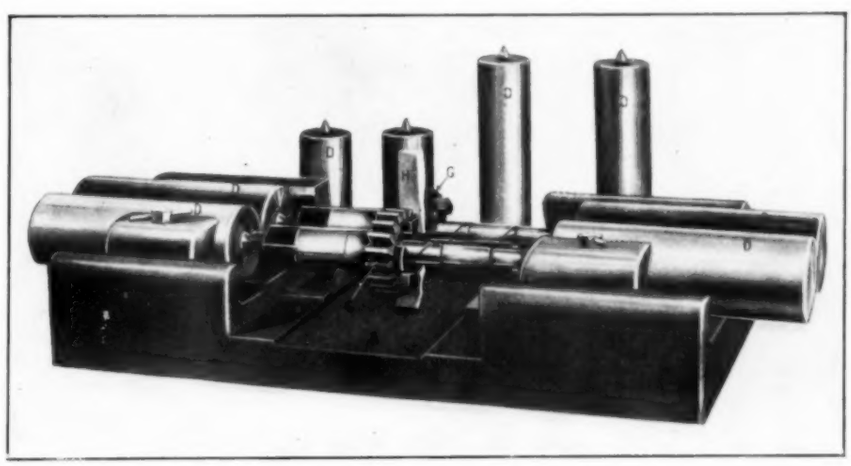


Fig. 2. With Gears in Place Being Tested

they are planed as shown at an angle so that when the cylindrical pieces *D* are clamped in place there will be no tendency for them to lift. Their upper surfaces are also planed for the cylindrical pieces to rest on. A seat for the clamps *F* is also planed at each end. The cylindrical pieces *D* are made of tool steel hardened and ground the pitch diameter of the gears to be tested, the bodies and centers being concentric.

Fig. 2 shows how they are used. Two gears *G*, which are to run together, are mounted on centers and two papers *H* are run between the teeth. The thickness of the two papers being 0.006 inch, the gears must turn with the two papers between, but four papers must not pass between the teeth of the gears. The changing from one size to another is readily effected by removing the centers in use and substituting a set of the pitch diameter of the gears to be tested. The device is absolutely fool proof, as it is impossible to make a mistake with it.

New York. E. M. BAIN.

## Facing a Coupling in Place

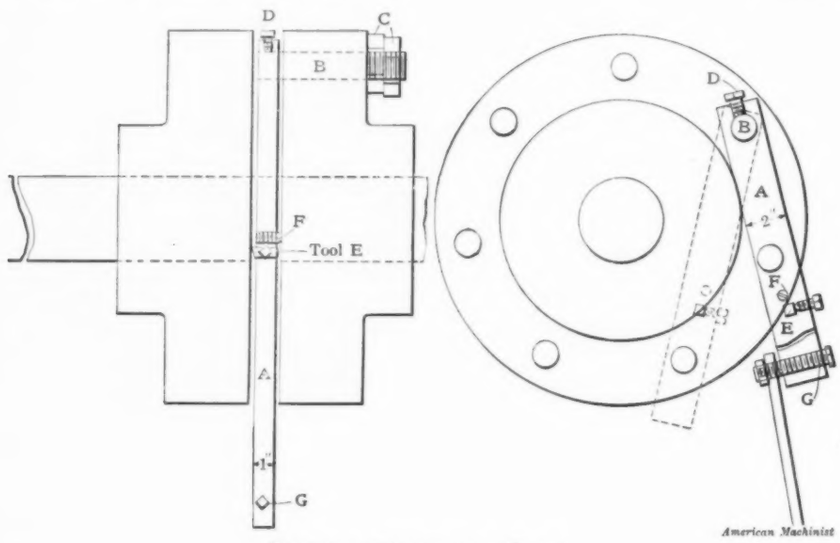
The main shaft used to drive generators at the Janesville, Wis., Electric Company's station, broke about 5 feet from a coupling and had to be repaired as soon as possible, or sooner.

It was decided that to put a coupling on shaft at break would be the best way to repair and this was done; the short (5-foot) end was taken to the machine shop and the coupling fitted, but the other piece had to be fitted with the half coupling without moving shaft.

A set of couplings used before was found and fitted on, but the half on the long piece of shafting was considerably out of true on the face after the key was driven in tight.

The short piece of shaft was put in place and moved endwise 1½ inches from the troublesome half. I then turned a pin *B* to fit the hole for the bolts in the coupling. I then took a piece of bar iron 1x2 inches and about 24 inches long, drilled a hole in one end to fit the pin *B* with a set screw *D* to hold it on one side and lock nuts on other end of pin to hold it against the face. A hole for the tool *E*, a screw *F* to ride on the face of the true half of the coupling and to hold the tool in the cut, and a screw *G* for a feed screw completed the fixture. The coupling to be faced was on a 4 5/16-inch shaft, and was 18 inches in diameter and had to be faced to about 11 inches diameter. A small motor was used to turn the coupling to be faced, the one half holding the fixture remaining stationary. The time used to make the fixture and face the coupling was not quite two hours.

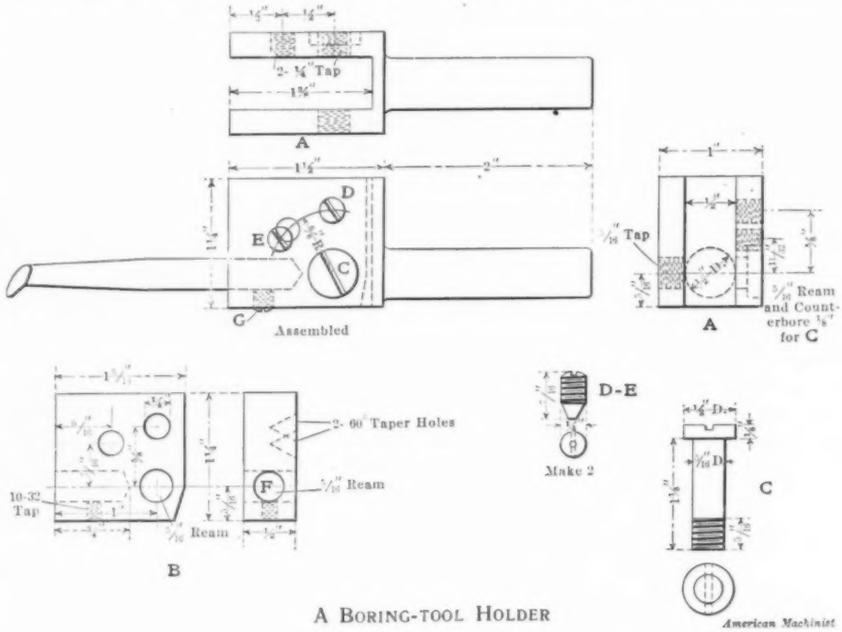
Janesville, Wis. H. E. LARSEN.




FACING A COUPLING IN PLACE

## A Boring Tool Holder

From the number of descriptions of boring tools and boring-tool holders which have been published in the last year or two, it would seem as if every other machinist had a pet idea as to what is the best tool, and, of course, I have mine. It is simpler to make, lighter and has a wider range than most of them. With my tool I can easily bore holes from ¼ up to 3 inches with the cutting point of the tool projecting not more than 4 inches from the milling-machine chuck.




A BORING-TOOL HOLDER

The tool consists of casing *A* and holder *B*. The holder *B* is inserted in the casing *A* and the screw *C* acts as a pivot on which *B* swings. *A* is of machine steel and is easily made. Cut off a piece of 1x1¼x3½-inch stock, locate it properly in the chuck and turn the shank ½ inch; then holding the piece by the shank mill the ½-inch slot for *B* to fit in. Locate the holes for *C*, *D* and *E* and the casing is finished. The holder *B* is also of machine steel and is made of ½x1¼x 1 5/16-inch stock. Locate the holes for *C*, *D*, *E*, *F* and *G*. *D* and *E* are adjusting screws and have 60-degree conical points as shown. *F* is a 5/16-inch hole for the boring tool and *G* is a set screw to hold the tool in place. All parts should be case-hardened.

Put *A* and *B* together and fasten with the screw *C*, now screw in *D*; next put in *E* and you will find that the taper hole in *B* does not aline with the tapped hole in *A*. Do not get alarmed, for this is just as it should be, for this is the adjustment of the tool. With *D* in tight, *E* just enters the taper hole in *B*. With the tool in this position the cutter bar inserted at *F* will be almost concentric with the shank of the casing *A*. Now unscrew *D*, say half a turn, and tighten up on *E*

and you have swung the holder *B* on the pivot *C*. The more you unscrew *D* the further in you can screw *E*. In this manner you can easily bore from the smallest holes up to 3 inches.

I make my tools of 5/16-inch drill rod and they vary in length and shape according to my needs.

Newark, N. J. JOHN MELVILLE.

## An Experience with Steel

As there has been some discussion regarding the treatment of high-speed steels I will give one of my own experiences.

Having charge of the tool job, it was up to me to select our steels. The superintendent favored a brand which I knew was O. K. for heavy tools, but was no good for taps and threading dies on account of the very high hardening heat, which fused the sharp corners. The steel I wanted was not carried in stock by the local dealers, but when they sent their steel man out to see us it was decided to give their steel a trial, for he represented it to be O. K. for taps and dies, and the hardening heats were far below those of any other steel, etc. I took a trial order of both carbon and high-speed steel on condition.

One of the first jobs was a fly cutter ¾-inch square. I hardened it in sperm oil and it came out glass hard, but as soon as the skin was ground off it was soft as mush. I took several tries at it and then called in the general foreman who had the same success.

We had some cutters and taps made up, so we called in the steel man to harden them. Of course, we didn't smile (while he was looking) for we saw trouble in big type. Results: Almost as good as we had obtained. He said, "It was all the fault of that bar of ¾-inch stock," so it was exchanged for another one, and "That carbon steel that worked so hard hadn't been properly annealed." Wouldn't we try some other pieces of stock, and send for him when we were ready to have them hardened? We said we would be delighted to do so.

In course of time we had a lot of pieces to harden and called for help. As luck would have it, the company's expert was in the city and came out. After getting on his white apron, rolling up his white shirt sleeves and tucking a kerchief under his collar, he started in to "show us." Yes, we grinned (on the side) and absorbed all the good advice handed out.

Some carbon-steel taps hardened beautifully, after two or three trials, and broke in less time than it took to harden them. That bar of ¾-inch stock *wouldn't* harden, so it was blamed to the firm in this country, who sometimes annealed stock that was sent over from England hard. Then the other cutters we had ready wouldn't harden, even in water. That was the fault of the fire. I gave him credit here, for the fire *was* poor, and let him take the rest of the lot to the city to harden as he saw fit.

They came back in a day or so with the corners melted off, and those that were hard clear through were so brittle that they broke like glass.

I think the steel man felt sore because I shipped the whole lot back, but nothing else was left to do. The carbon steel was used for arbors and boring bars, and a couple of good old standard brands ordered, with the result that we had no more trouble.

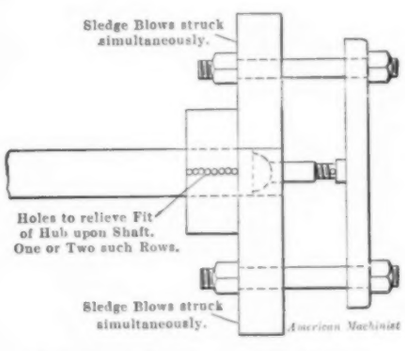
I've had a good many years' experience in the working of steels, and find that I am never too old to learn, and always give a new man a chance to make good, but when he falls down on his own deal I believe it's time to cut his acquaintance.

Now I don't say that those steels were worthless for when properly treated they might have been all that they were represented to be for the work they were intended for; but we had to have a steel that could be successfully handled under ordinary conditions.

Easton, Penn. H. M.

## A Stubborn Repair Job

Some time ago it became necessary during the work of a large manufacturing plant to remove a rather large coupling from the shaft of a motor that was used for the driving of large generators on the test floor. And since we had a decidedly interesting time of it, before the trick was accomplished, I have thought the job might be worth describing as an example of what sort of an experience an erecting man occasionally gets up against.


Sledge Blows struck simultaneously.
Holes to relieve Fit of Hub upon Shaft. One or Two such Rows.
Sledge Blows struck simultaneously.
American Machinist

REMOVING COUPLING FROM SHAFT

The motor shaft was about 6 inches in diameter. As it was considerable of a job to dismantle the motor in order to get the shaft and armature out, so that the coupling could be taken off in a powerful press that was at hand, the job was started by hand. A strong screw jack was placed on the end of the shaft and tightened up against a strong V clamp that had previously been attached to the coupling by bolts, as shown in the sketch.

Tightening the jack screw to the limit of the small end of a crowbar, which the holes in the screw would accommodate, did no good; the next step was to tighten the nuts on the bolts. These, having a finer thread than the jack, would give a stronger pull while they lasted, which was not long.

After replacing the broken bolts with new ones, two husky men with 12-pound sledges were induced to strike simultaneously upon opposite sides of the back face in an attempt to drive the piece off while a third man with a sledge and wrench, kept the bolts up to the strongest tension deemed safe. This method failed.

As the saving of the coupling was not the most important part of the job, a row of ⅝-inch holes was then drilled through the hub, down as close to the shaft as possible without drilling into it. This row of holes was laid out on a line parallel to the axis of the shaft (see sketch) and was expected to relieve the fit enough to allow the coupling to be forced off, which another session of sledge work showed it had failed to do. A second row of holes, similar to the first, was then drilled and the sledges again brought into play, with the same result—the fit was still apparently as solid as Gibraltar.

As the case was becoming desperate, a large blow torch was rigged up and connected by hose to the city gas mains and the compressed-air system of the shops. This flame played on the coupling while the shaft was protected from the heat as much as possible by asbestos sheeting. After the coupling had been heated up to a blue heat, the fit slowly yielded; urged by the sledge blows of four good, husky helpers, working in relays, while a fifth kept the bolts strained to their limit. Not until the hub had a bearing of only one inch on the shaft could it be moved by the jack screw.

After some three days' work by from three to five men, the shaft was removed, and then I commenced to look up the history of the case. The hole in the hub had originally been too large for the shaft and had been shimmed up with sheet iron. Then, because the hole was now too small, the coupling had been heated and forced on, in the above-mentioned press, with a total pressure of 50 tons, while *hot*. It was thus no wonder that it came off hard by hand, but, as the road-erecting man said: "I'm glad it happened right in the shop, for had it been outside, every man here would have been ready to call me a fool and would have been intimating that I didn't know my business."

Milwaukee, Wis. H. B. M.

## A Drill Chuck for the Tailstock

Anyone operating a lathe in a jobbing shop knows how often it is necessary to drill holes in work held in the chuck on the live spindle. The drill chuck is usually mounted on a taper shank fitting the tail spindle. This necessitates the removal of the tail center and results in much loss of time.

The drill-chuck body, shown in Fig. 2, and the center drill holder, shown in Fig. 3, obviate the taking out of the tail center as they slip over it.

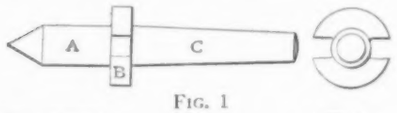



FIG. 1

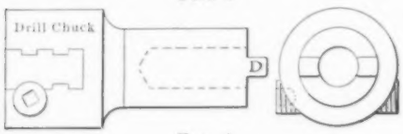



FIG. 2

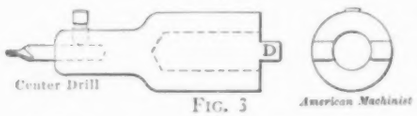



FIG. 3

A DRILL CHUCK FOR THE TAILSTOCK

To use these devices a special tail center is made, as shown in Fig. 1. The part *A* is straight, about three diameters in length. The collar *B* has two notches milled in it, to accommodate the lugs *D*. The collar *B* can be either shrunk or pinned on, as desired.

California. J. H. FRESH.

## The Melville Macalpine Reduction Gear

This somewhat astonishing set of "herringbone" or double-spiral gears appears to be an object of interest to many just now, and not all of them gear men.

Your statement that they have totally knocked out the calculations of the "best authorities" leads me to the remark that I have never heard of a practical test on the strength and power of gearing that did not knock out all calculations and authorities. It is well, in cases of that sort, to test the gears first and then make the calculations to fit the test. The problem is not within the reach of exact mathematics.

But, with regard to the spiral gear, herringbone or otherwise, it may be remarked that theory points to one result that would probably agree very well with experiment, and that is that since the teeth of spiral gears press against each other at an angle, there is a lateral or wedging action, and it is this wedging action that requires the gears to be made in pairs, right and left. If the two gears, right- and left-hand, were separate, they would tend to pull apart and the pressure between the teeth would vary directly as the secant of the angle of the spiral. If the angle was 45 degrees for example, the pressure between the teeth of the gears would be 1.41, or nearly one and a half times the direct pressure being transmitted. Therefore, since the friction between the teeth is directly as the pressure, it follows that the friction of the spiral gear of 45 degrees is nearly 50 per cent. more than that of the common spur gear.

If the Melville Macalpine gear did well as to efficiency, then the ordinary straight spur gear in the same place would have shown a better result.

The spiral gear has its place, but not in one case out of 20 where it is used, and it is particularly and always whether single or double, unfitted for the transmission of power. I do not know of a solitary case where spiral gears have been compared, practically, with properly cut and mounted spur gears, under the same circumstances, so that the whole question is a matter of judgment. For high speeds the combination of a worm and worm gear does very well in the matter of efficiency, but I believe that a pair of bevels and a pair of spurs doing the same work in the same place would show a better result.

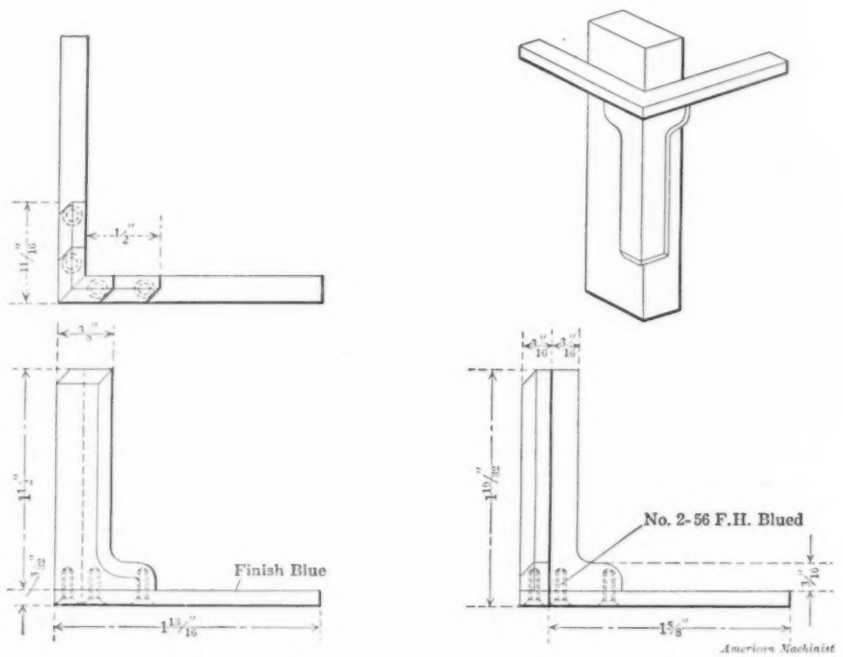
Why the "floating frame" of the Melville Macalpine gear? I have heard of no explanation and can think of none except the one that the gears are so wretchedly cut that they need some sort of wabbling mounting to accommodate the wabbling action of thick and thin teeth. If the gears are properly cut and accurately spaced, the floating frame would serve no purpose whatever and might as well be bolted down hard in its place. This floating frame is the only visible reason for mounting the two pairs of gears so far apart. Perhaps they would take up less room and weigh and cost something less if bolted close together without the floating frame. But it is sometimes necessary to have some sort of queerness in a machine to make it look mysterious and difficult and bewilder the unsophisticated. The floating frame is an excellent foundation for a .... patent.

If Melville and Macalpine will try the experiment over again with plain spur gears, they will probably get a better result than with the spirals. Perhaps a "stepped-gear" set, several spur gears of narrow face bolted together to make one wide-faced gear with staggered teeth, would give a little smoother action. Such a combination is a good substitute for the herringbone style without its lateral strain and friction and far easier to make.

Lexington, Mass. GEO. B. GRANT.

## A Handy Corner Square

Accompanying is a sketch of a square which I made some time ago and which has been found very useful to a toolmaker. Very often we have occasion to strike a line around the inside or outside of a corner. Ordinarily, you would have to put a square on one side and strike a line, then change it to the other surface and make a line to intersect, or else use a surface gage. With this tool placed on the edge of the work, you strike both lines at once, and their intersection is accurate.




A CORNER SQUARE AND ITS USE

Jersey City, N. J. F. W. KILLAM.

# The S. K. F. Ball Bearings

*Special Correspondence*

The Swedish ball bearings manufactured by the Aktiebolaget Svenska Kullagerfabriken, of Gothenburg, are just being introduced into this country. The radial bearings are made in four types, light, medium, heavy and extra heavy. Of these the first three correspond in general dimensions and capacities with the three types with which the trade is already familiar.

Fig. 1 shows at the left a radial bearing of the extra heavy type, in the center a radial bearing of the medium type, and at the right a self-contained double thrust bearing.

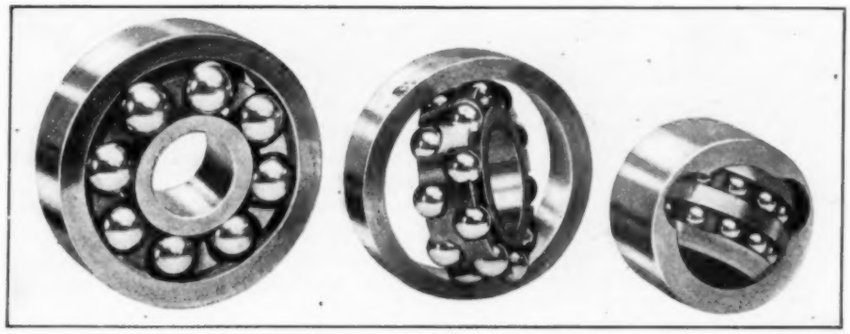


FIG. 1. S. K. F. BALL BEARINGS

FIG. 2. S. K. F. BALL BEARINGS DISASSEMBLED

Fig. 2 shows a radial bearing and the thrust bearing disassembled, while Fig. 3 shows in a diagram the relationship between the inner and outer races, the two rows of balls and the ball cage of a radial bearing.

The feature of this bearing, as seen in Fig. 3, is the spherical bearing surface of the outer race, having a radius struck from a center on the axis of the bearing shaft. Because of this construction it is possible to swing the inner race with the ball cage filled with balls, as shown in the center bearing of Fig. 1. The cage is made of phosphor bronze and the recesses holding the balls are a trifle wider than the ball diameter, so that the balls have a little freedom when in place. A light pressure is needed to snap these balls into place after the cage is slipped around the inner race; thus the inner race, cage and balls become a unit when assembled. To remove this unit from the outer race it is necessary to snap out a few adjacent balls or two pairs of balls diametrically opposite. A feature of the cage, also, is the absence of rivets or screws. It will be noted that the two rows of balls are staggered, both when viewed along the axis of the bearing and at right angles thereto.

It is claimed that the curvature of the outer race is such that the areas of contact between each ball and the inner and outer races are equal.

Furthermore, the spherical shape of the outer ball race allows freedom for deflection of the shaft with load and any lack of alinement is taken care of without excessive pressure being brought upon any one ball.

The double thrust bearing shown in Figs. 1 and 2 is equally ingenious in construction. The inner outlines of the shell are such that they form spherical seats for the washers, rendering them self-alining and through the opening shown at one end, all of the parts can be inserted and removed with ease and without the use of tools.

In addition, the company manufactures single and double thrust bearings without housings and several types of radial bearings adapted for many classes of service.

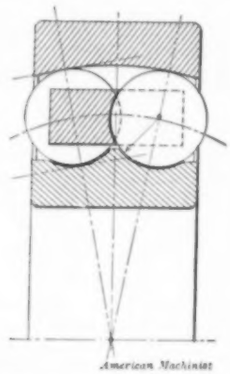



FIG. 3. DIAGRAM OF BALL CAGE AND RACE RELATION IN S. K. F. RADIAL BEARINGS

These bearings are being introduced into this country by the S. K. F. Ball Bearing Company, 50 Church street, New York City.

## OBITUARY

J. J. Connell, general superintendent of the Nicetown plant of the Link-Belt Company, died on April 18 after a short illness. Mr. Connell was but 39 years old.

F. J. Plummer, until a few years ago superintendent of the C. B. Rogers Machine Company, Norwich, Conn., died in that city on April 15. Prior to 1890, Mr. Plummer was superintendent of the S. A. Woods Machine Company for a number of years. He was 69 years old at the time of his death.

John W. Blanchard, founder of the Blanchard Machine Company, Cambridge, Mass., of which he was president until four years ago, died on April 18. Mr. Blanchard was 78 years old and had engaged in the manufacturing business for nearly 50 years. His son, Winslow Blanchard, is now president of the Blanchard Machine Company.

---

The public in general has but a faint idea of the tremendous amount of cement which is being used in the construction of the locks at Gatun and Miraflores on the Panama canal. Over 3000 barrels of cement is now being laid in place daily at these two plants. An interesting sidelight on this feature of the work is that voucher has just been drawn by the Atlas Portland Cement Company, the contractors for the cement, in favor of the Isthmian Canal Commission, in the amount of $23,000, which money is being paid the commission as bonus on empty cement bags returned from the isthmus in one shipment. These shipments of returned bags are being made continuously.

# Overhead Charges and Machine-hour Rates* *By Charles Robbins†*

The following analysis outlines a method of determining the hourly overhead charges per machine tool, which will be called the *machine-hour rates.* Overhead charges can be grouped in three main classes:

*A* Charges against the entire factory.

*a* Fixed charges: these include interest and depreciation, taxes and insurance on buildings, grounds and accessories.

*b* Variable charges: these include repairs and renewals on buildings and accessories, omitting all charges which can be set off directly to a particular section of the factory; charges against the store room and the tool room; defective design, material or workmanship; printing and stationery; lubricants and general manufacturing supplies.

*c* Salaries (not chargeable to a definite section): these include cost of superintendence (manager, superintendent, foreman); engineering and drawing; clerical force, including office boys and general laborers.

*B* Charges against each section of the factory.

*a* Fixed charges; including an equitable portion of the total factory fixed charge and interest, and depreciation on auxiliary apparatus located in the section (except machine tools).

*b* Variable charges: these include a portion of the variable charges as well as similar charges belonging to the section, such as repairs and renewals, storeroom and toolroom charges, defective design, material and workmanship, lubricants and manufacturing supplies.

*c* Salaries: including a portion of the total salaries as well as those belonging exclusively to the section, that is, foremen, clerks, errand boys, laborers, cranemen, etc.

*C* Charges against each machine tool.

*a* Portion of fixed charge.

*b* Portion of variable charge.

*c* Portion of salaries charge.

*d* Interest on cost of tool, fairly taken at 6 per cent.

*e* Depreciation of value of tool (see explanation below).

*f* Cost of power to operate tool, including also lighting and crane service.

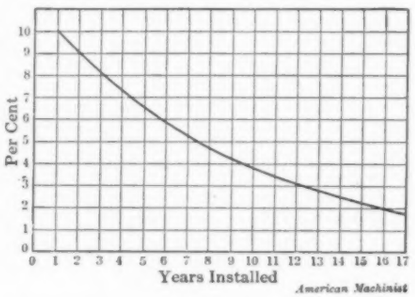



FIG. 1. DEPRECIATION AT 10 PER CENT. REDUCING BALANCE

| Type of Machine. | Charges per Hour. Fixed. | Variable. | Salaries. | Interest. | Depreciation. | Power. | Total or Machine Hour Rate. |
|---|---|---|---|---|---|---|---|
| Vertical Boring Mills: | | | | | | | |
| 40 in.–60-in. | $0.02 | $0.25 | $0.15 | $0.05 | $0.05 | $0.01 | $0.53 |
| 72-in.–100-in. | 0.04 | 0.45 | 0.25 | 0.08 | 0.08 | 0.01 | 0.91 |
| 10-ft.–14-ft. | 0.05 | 0.80 | 0.40 | 0.15 | 0.15 | 0.02 | 1.57 |
| 16-ft.–24-ft. Ext. | 0.08 | 2.00 | 1.00 | 0.30 | 0.30 | 0.03 | 3.71 |
| Average per cent. of total | 3% | 52% | 28% | 8% | 8% | 1% | 100% |
| Radial drills, 5 ft. | $0.02 | $0.30 | $0.20 | $0.03 | $0.03 | $0.01 | $0.59 |
| Radial drills 10 ft. | 0.04 | 0.60 | 0.35 | 0.09 | 0.09 | 0.01 | 1.18 |
| Average per cent. of total | 3% | 51% | 31% | 7% | 7% | 1% | 100% |
| Engine Lathes: | | | | | | | |
| 30 in.–40 in. | $0.02 | $0.25 | $0.12 | $0.04 | $0.04 | $0.01 | $0.48 |
| 40 in.–60 in. | 0.03 | 0.50 | 0.25 | 0.10 | 0.10 | 0.01 | 0.99 |
| Average per cent. of total | 3% | 51% | 25% | 10% | 10% | 1% | 100% |
| Planers: | | | | | | | |
| 36 in.–56 in. | $0.04 | $0.55 | $0.30 | $0.05 | $0.05 | $0.01 | $1.00 |
| 7 ft.–10 ft. | 0.06 | 1.10 | 0.60 | 0.15 | 0.15 | 0.02 | 2.08 |
| 12 ft.–14 ft. | 0.15 | 2.60 | 1.40 | 0.25 | 0.25 | 0.03 | 4.68 |
| Average per cent. of total | 3% | 55% | 30% | 5.5% | 5.5% | 1% | 100% |

TABLE 1. MACHINE HOUR RATES.

### DEPRECIATION OF VALUE OF MACHINE TOOLS

A method frequently used in calculating the depreciation in value of a machine tool is to allow 10 per cent. of a reducing balance; that is, 10 per cent. of the first cost if charged off the first year, 10 per cent. of the remaining cost the second year, and 10 per cent. of the second remainder the third year, etc. This method is based upon the fact that the apparatus actually decreases in value year by year. Allowance for depreciation in any given year can be made easily by the aid of the curve in Fig. 1. This curve gives the percentage of the first cost corresponding each year to 10 per cent. on the reduced balance. For example, the curve shows that the depreciation on a tool that has been in service five years will be 6.6 per cent. of the original cost. If this cost was $4500, the allowance for depreciation during the sixth year, according to the 10 per cent. reducing balance method, is $4500 × 0.066 = $297. Since this is 10 per cent. of the reduced cost, the value of the tool at the end of the fifth year is $2970.

Tools designed for special work will be discontinued after a comparatively limited period, and therefore, depreciate in value much more rapidly than is indicated by the foregoing method; a special allowance frequently made for such tools is generally known as *utility depreciation.*

Table 1 contains a summary of machine-hour rates obtained by this method. It is assumed that machines have been installed six years, so that the depreciation is 6 per cent. on a basis of 10 per cent. reducing balance.

*Abstract from *Journal*, American Society of Mechanical Engineers.

†With Westinghouse Electric and Manufacturing Company.

## Machine Tool Calculator for Milling Machines*

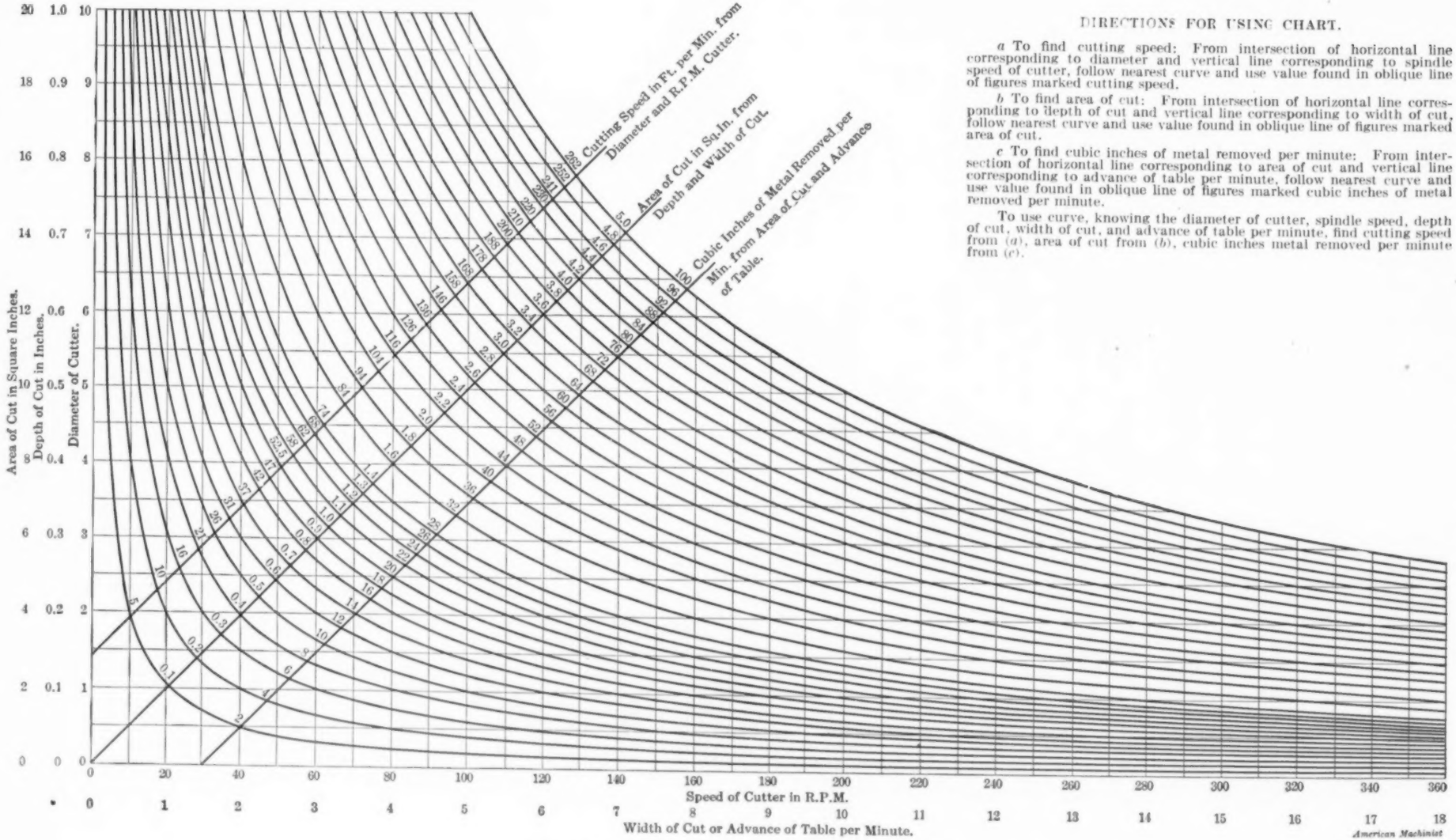
The chart has full instructions for determining the amount of metal removed per minute by a milling machine.

Example: Width of cut = 8 inches; depth of cut = 0.2 inch; advance of table per minute = 5 inches; area of cut is 8 × 0.2 = 0.16 square inch.

To find the cubic inches of metal removed per minute, find on the diagram the intersection of the horizontal line through 0.16 square inch, and a vertical line corresponding to a table advance of 5 inches per minute. The curve passing through this intersection corresponds to a rate of cutting of 16 cubic inches of metal per minute. For machinery steel or mild steel, the power required by a horizontal milling machine of this type is about 1.6 per cubic inch per minute, making the total requirement 1.6 × 16 = 25.6 horsepower. A vertical miller requires about one horsepower per cubic inch per minute, or 16 horsepower under the foregoing conditions.

The power required by milling cutters varies according to their construction, and care should be employed to determine the proper constant for each class of cutters.

*Abstract from *Journal*, American Society of Mechanical Engineers.


Cutting Speed in Ft. per Min. from Diameter and R.P.M. Cutter.
Area of Cut in Sq.In. from Depth and Width of Cut.
Cubic Inches of Metal Removed per Min. from Area of Cut and Advance of Table.
Area of Cut in Square Inches.
Depth of Cut in Inches.
Diameter of Cutter.
Speed of Cutter in R.P.M.
Width of Cut or Advance of Table per Minute.
American Machinist

MACHINE TOOL CALCULATOR FOR MILLING MACHINES

DIRECTIONS FOR USING CHART.

*a* To find cutting speed: From intersection of horizontal line corresponding to diameter and vertical line corresponding to spindle speed of cutter, follow nearest curve and use value found in oblique line of figures marked cutting speed.

*b* To find area of cut: From intersection of horizontal line corresponding to depth of cut and vertical line corresponding to width of cut, follow nearest curve and use value found in oblique line of figures marked area of cut.

*c* To find cubic inches of metal removed per minute: From intersection of horizontal line corresponding to area of cut and vertical line corresponding to advance of table per minute, follow nearest curve and use value found in oblique line of figures marked cubic inches of metal removed per minute.

To use curve, knowing the diameter of cutter, spindle speed, depth of cut, width of cut, and advance of table per minute, find cutting speed from (*a*), area of cut from (*b*), cubic inches metal removed per minute from (*c*).

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American Machinist

# Editorial

## Efficiency of Large Gears

Many of us know things that are not so, and with some of us a part of this useless knowledge may be in regard to the efficiency of large gears.

We believe that we are well within the bounds of truth in saying that the majority believe that large gears are very inefficient.

This misinformation or lack of information is easily explained. The data that are available in regard to the efficiency of gears of any size are few at best and apply to pinions and small gears. Large gears have not been extensively tested, for there are but few technical schools and factories equipped with appliances for gear testing and capable of absorbing several thousand or even several hundred horsepower. Again we do not always distinguish between a large gear with cast teeth and a similar gear with cut teeth.

In the early days of factory engineering, gear drives were common for transmitting power from shaft to shaft throughout the plant. As time went on these drives were replaced—in some cases by belting, in other cases by a change from mechanical transmission to electrical distribution of power. It has been very easy to assume that the reason for discarding the gears was because of their inefficiency. Enthusiastic advocates of electric drive have time and again referred to the substitution of motors for mill gearing with elation and have either stated or implied that the change brought about a great saving of power.

In further support of the common belief that gearing in large sizes is inefficient we quote the following from the presidential address of Mr. Denny to the Institution of Marine Engineers, in England, on October 5, 1908: "It has frequently been suggested that if some inspired engineer could evolve a system of gearing that would be lasting and reliable, not too noisy, and would not absorb in friction more than, say, 10 per cent. of the power, turbine engines would be capable of application to any speed of vessel and to any size of propeller." Here, Mr. Denny gives expression to an oft repeated suggestion, that if large gearing could be made having an efficiency of 90 per cent., a big step forward would be made.

With direct bearing on this belief we have the record of performance of the largest gears in point of horsepower ever made and tested—the Melville-McAlpine reduction gear through which 6000 horsepower has been transmitted.

To show the measure of the performance we quote a paragraph from an article by George Westinghouse in the January number of *The Electric Journal:* "Considering the important bearing of the question of efficiency on the ultimate success or failure of the gear, it is peculiarly gratifying to have found by repeated trial and careful measurement that the transmission loss hoped for by Mr. Denny has been divided by seven. To be exact, the efficiency surpasses the more than satisfactory figure of 98.5 per cent."

The hope was for an efficiency of 90 per cent., the fulfilment was an efficiency of 98.5 per cent.

Large bevel-gear drives have perhaps been especially condemned; it is, therefore, of interest to read the following from a paper presented by Prof. C. M. Allen, to the American Society of Mechanical Engineers, on the testing of water wheels: "The total horsepower delivered to the generator was approximately 700. The driving gear was of the ordinary wood-mortise type, outside diameter 6 feet 5 inches approximately, with 68 teeth 14 inches wide, meshing with a cast-iron pinion which had 48 teeth with planed-tooth outline. At full load the loss of the gear was 3.5 per cent. and 3.4 per cent. for two separate units, or the efficiency of the horizontal-shaft vertical-wheel gear drive was about 96.5 per cent. The gears were well lubricated with a thick grease.

"About nine months later it was necessary to test one of these same units in exactly the same manner. The loss in gears this time was a trifle less, the test giving 3.1 per cent.

"All of the information obtained concerning the loss due to bevel-gear drives leads the writer to conclude that if gears are properly designed, set up, and operated, and are not overloaded intermittently or continuously or left to care for themselves, they should show an efficiency of from 95 to 97 per cent."

Are not these bevel-gear drives efficient

compared with the majority of mechanical devices?

As a matter of fact do not the above figures agree with common sense? The quantity of heat generated by the absorption of one horsepower for an hour is 2545 British thermal units. If we try to give an expression to the statement that large gears are inefficient by assuming a loss of 10 per cent., in the case cited by Professor Allen, 70 horsepower would be dissipated in heat. A multiplication will show what this means in British thermal units per hour and the presumption is strong that the gears would heat, cut and wear under such a condition.

The same reasoning will probably apply to many large-gear drives concerning which there has been speculation in regard to efficiency. Had they been extremely inefficient they would not have operated satisfactorily for a long period of time.

These figures show that large-gear drives are not necessarily inefficient, but on the contrary may be decidedly the reverse.

## A Social Effect of the Automobile

While the effect of the advent of the automobile on the various industries has received great attention, there is one phase of the matter that has been hardly noticed at all, yet it is present with us at all times. The automobile has done more to increase the public estimate of the dignity of labor than any other force in modern history. Press and pulpit have both tried in their way to laud the social importance of the laboring man, with no other effect than to call greater attention to his shortcomings; but when an automobile owner has to sit on the fence while his paid chauffeur crawls under the machine and gets it to running again, he feels ashamed to have his friends ride by or stop and offer advice which he cannot understand. He would be proud to say that he was the one who found the broken wire or the checknut, that was all that was the matter with the machine.

Three-fourths of the cars are owned by men who are steadily increasing their respect for the "greasy mechanic" and outdoing him, as to grease, at least, in learning what there is inside their cars and how to keep them going. Any person naturally respects the man who can show him that he knows something that he needs to know. In the days when the average man's intercourse with machinists consisted in telephoning to the shop for them to send up after his lawnmower once a year, he had no chance to respect the latter's knowledge; but when he owns an automobile it involves constant use of machine-shop facilities, machine-shop language and association with grease and machinists, and he necessarily finds that this former "greasy mechanic" is possessed of a store of knowledge more valuable than his own.

As a result, our lawyers and doctors are acquiring a healthful respect for the men who can do things, and a desire to do things themselves that has led more than one of our acquaintances to fit up a shop of his own in his garage. All of which leads to the observation that "A man's a man for a' that" and all that is needed to make men see it is a common interest.

## The Growth of Workmen's Compensation Laws

With the unmistakable trend toward legislation in the direction of prescribing compensaton for injured workmen instead of the present system, which induces costly litigation that embitters both sides, it is well to be familiar with the laws which are already in force in other countries.

Bulletins of the Bureau of Labor contain some interesting information along this line and we find that this is practically the only country where the laws do not give compensation, without suit, to workmen who are injured in the industries. These laws vary widely, but in all except Austria, Germany, Hungary and Luxemburg, the entire burden rests on the employer; in the four named, it is divided between the two parties. With the exception of Sweden, it is based on the average wages of the injured party.

In most of the countries, the employer may contract with state or private insurance companies to handle the claims and in some this is compulsory. Provision is usually made to protect the beneficiary against insolvency.

In most countries the law applies to those engaged in actual manual work only, or those exposed to similar risks, but in Belgium, France and Great Britain practically all employees are included. Most states exempt intentional or gross negligence, but some consider this percentage too small to be taken into account.

The list includes Austria, Belgium, British Columbia, Cape of Good Hope, Denmark, Finland, France, Germany, Great Britain, Greece, Hungary, Italy, Luxemburg, Netherlands, New Zealand, Norway, Queensland, Russia, South Australia, Spain, Sweden and Western Australia.

Add to this the investigations that are being made in a number of our own States and it will be seen that the question is one that it is well worth while to consider carefully.

## National Metal Trades Convention—Error

A typographical error that crept into the paper covering the Cincinnati Continuation School, published in the report of the above convention, might be misleading. On page 757, second column, the paragraph commencing "Three lessons cover the course," etc., should have read "These lessons cover the course," etc.

## PERSONALS

*Items For This Column Are Solicited*

John C. Perrin, superintendent and designer of the Lozier Motor Company, sailed on April 28 for an extended trip through Europe.

Walter G. Scott, formerly employed by the Allis-Chalmers Company, has been appointed chief draftsman of the Cyclone Drill Company, Orrville, Ohio.

Samuel L. Platt, a frequent contributor to our columns, has accepted the position of assistant treasurer with the Bradley Rust-Proofing Company, of Brooklyn, New York.

A. F. G. Fritz, formerly connected with the Tee-Square and Triangle Company, Newark, N. J., has become chief draftsman of the Hartford Suspension Company, Jersey City, N. J.

Charles W. Werst, until recently general foreman of the Baldwin Locomotive Works, Philadelphia, Penn., has accepted the position of assistant superintendent of Lima Locomotive and Machine Company, Lima, Ohio.

C. A. Nourse, for the past three years with the Alden Sampson Manufacturing Company, Pittsfield, Mass., as superintendent, has resigned to take a position with the American La France Fire Engine Company, Elmira, N. Y., as machine-shop foreman.

Arthur W. Cash, mechanical engineer engaged in the manfacture of special valve apparatus, has become associated with the H. Mueller Manufacturing Company, Decatur, Ill., and will be in charge of the regulating-valve and engineering department.

William H. Taylor, formerly chief engineer of George V. Cresson Company, and more recently mechanical engineer of Tabor Manufacturing Company, Philadelphia, has been made manager of the engineering department of the Federal Advertising Agency, New York.

William W. Estes, until recently a member of the engineering staff of the Rhode Island Company, has accepted a position with the General Fire Extinguisher Company, Providence, R. I., where he will design machinery to be used in the manufacture of pipe fittings and similar work.

# New Tools and Machine Shop Appliances

**Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost**

*ANY new or improved machine or shop appliance of interest to our readers will be illustrated and described in this department.*

*A full and more detailed description will be given—when of special interest and it appears here before being sent elsewhere.*

*ALL descriptions appear in all four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.*

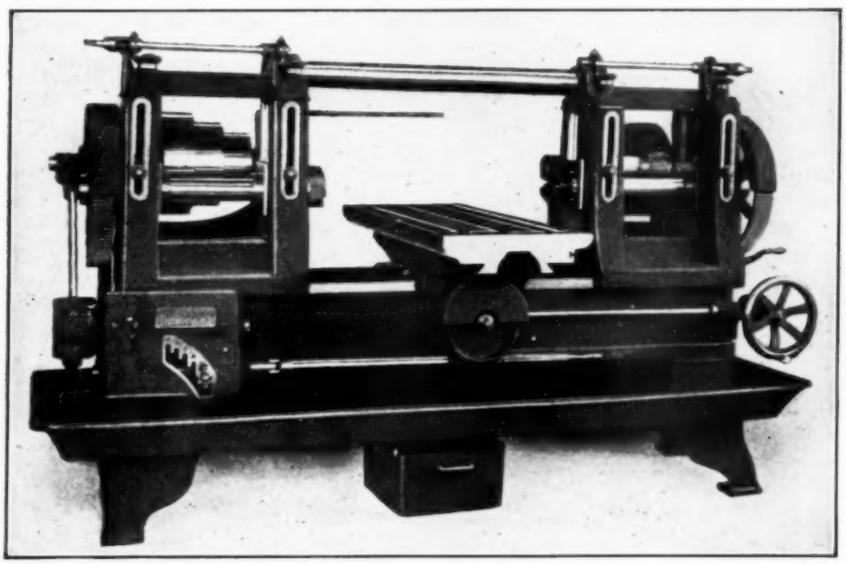
## A Double Head Lincoln Milling Machine

The halftone shows a double-head Lincoln milling machine, known as their No. 8, which has just been put on the market by the Hendey Machine Company, Torrington, Conn.

The main spindles of hammered steel have a hole 1¼ inches diameter through them. The spindle journals are tapered, the front ones being 5¾ inches long by 4⅛ inches diameter at the largest part tapered to 3⅜ inches. The noses of the spindles are 3½ inches diameter threaded 3½ threads per inch and are reamed No. 12 Brown & Sharpe taper. The cone pulley on the driving shaft has 3 steps for 4-inch belt; the ratio of the gearing is 6 to 1. The driving shaft is carried in a rocking frame permitting quick adjustment when the spindle hight is altered. Overhead elevation is used on the spindles, reading to thousandths. The spindles are held in position, not only by the elevating screws but by binding bolts which pass through the upper part of the boxes and clamp the uprights and boxes rigidly together.

The machine is built in six sizes with beds from 62 to 97 inches in length, and permitting a maximum distance between spindle noses of from 9 to 44 inches.

The table has a working surface 15x54 inches and is provided with three ⅝-inch T-slots. It has an automatic feed of 36 inches. The saddle provides a bearing of 34 inches for the table. There are 12 changes of feeds from 0.010 to 0.130 inch per turn of spindle, with reverse mechanism.



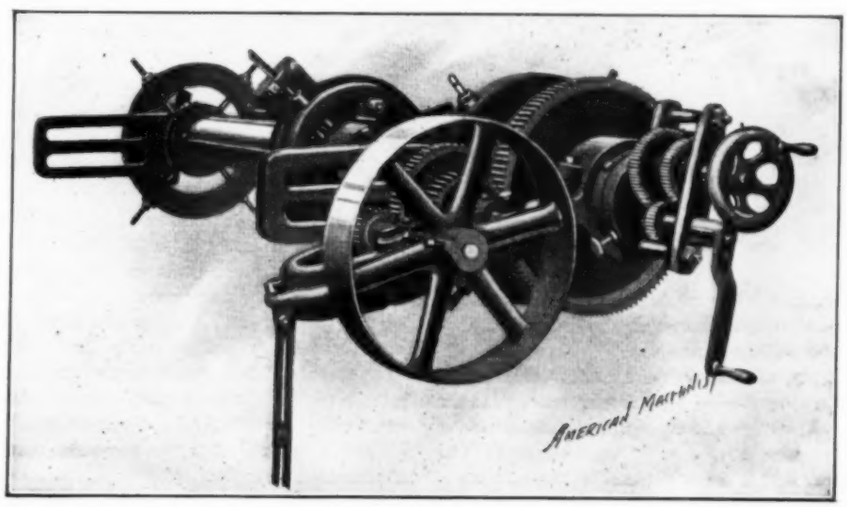
DOUBLE-HEAD LINCOLN MILLING MACHINE

## Portable Cylinder Boring Bar for High Speed Tools

Following the development of machinery for the use of high-speed steel comes the Ryerson portable cylinder boring bar, herewith illustrated. While primarily designed for reboring locomotive cylinders, it is equally applicable for steam engines, steam hammers, air hoists, etc. The construction of this device has been made extra heavy for the use of high-speed steel tools. Among the novel features may be noted a continuous feed instead of the usual star feed. Furthermore the tool holder is made so that straight tools may be used, thus avoiding chattering.

This machine is made in two sizes; No. 1 with 4-inch bar, and the No. 2 with 6-inch bar. Arrangement is made so that the No. 1 bar may be given two feeds and the No. 2 bar, three feeds. These are obtained by change gears and are instantly available. Another feature is that different size tool heads may be used, these being easily attached to the master head which is permanently located on the bar. All of the principal parts are steel, the frame being a steel casting.

The 4-inch bar is arranged for boring cylinders from 9¾ to 30 inches diameter, and up to 44 inches in length. The 6-inch bar is suitable for bor-




RYERSON PORTABLE CYLINDER BORING BAR

ing cylinders from 20 to 50 inches diameter, and up to 35 inches in length. Where there are no clearance blocks on either end of the cylinder and end of bar can be located in stuffing box of back cylinder head, these lengths may be increased to 50 inches for the 4-inch bar, and 46 inches for the 6-inch bar. Special sizes can also be furnished.

Drive may be either by pulley, direct gear, or with Morse taper shank for operation by air or electric drill. For severe service most railroad shops use 2½ to 3½-horsepower electric motor. Numerous accessories and attachments are included with the machines.

Weight of the 4-inch bar with necessary equipment for boring cylinders up to 13 inches diameter is 1000 pounds; furnished complete for boring cylinders up to 30 inches diameter, the weight is approximately 1500 pounds. The 6-inch bar equipped for boring up to 25 inches diameter weighs 3000 pounds and with equipment for 50 inches diameter, approximately 3700 pounds.

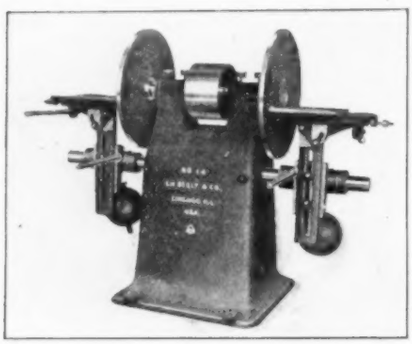
This machine is made by Joseph T. Ryerson & Son, Chicago, Ill.

## Powerful Disk Grinder

The principal item of interest in this new Besly grinder is its tremendous driving power as it requires about thirty horsepower to perform its maximum work. There are geared lever feed tables on both ends for two operators.

The wheels are 26 inches diameter by 13/16 inch thick, and weigh about 125 pounds each. Spindle pulley is 12 inches diameter for 7-inch belt.

Table bed has two T-slots and a keyway for attaching angle plates, magnetic chucks or other workholders, by means of



NEW BESLY DISK GRINDER

which work may be held in any desired position and forced against abrading disk with sufficient pressure to secure full efficiency of machine and circle, without undue exertion on the part of the workman.

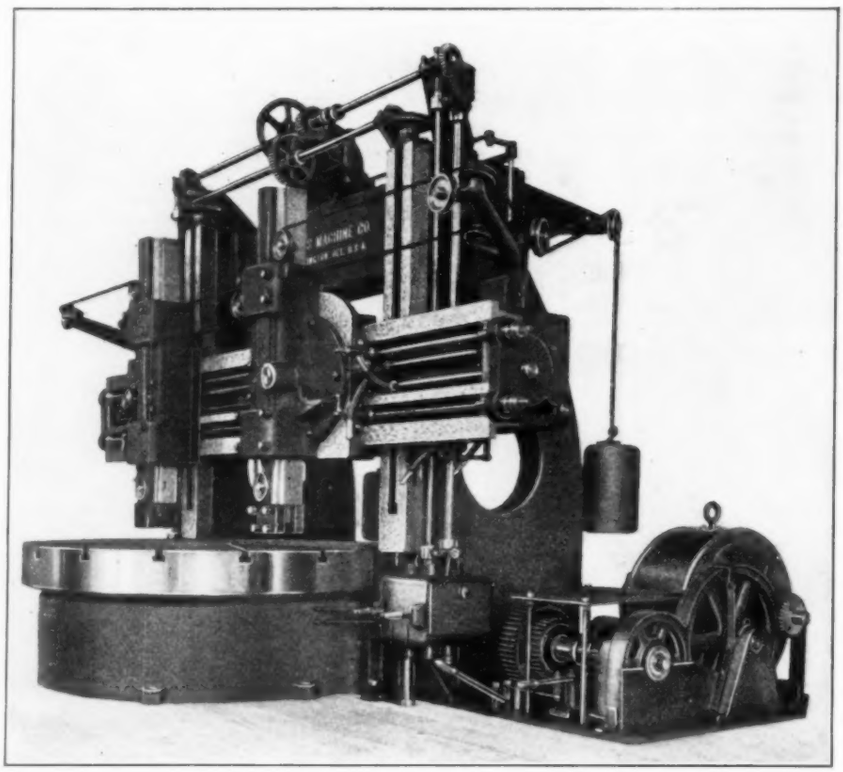
A comparatively short lever gives a leverage of 14 to 1, by reason of the geared motion and adds to the compactness and ease of handling.

The end thrust of spindle is taken in both directions on hardened and ground tool-steel thrust collars, and end play of spindle is taken up on a single bearing bushing. With this construction there is no tendency to tighten and stick the bearing, because the longitudinal expansion from heat in the crucible-steel spindle is slightly greater than in the cast-iron bearing bushing. This method of taking up end play in spindle is said to allow these grinders to commercially produce cast-iron printer's blocks to size within a limit of 0.0005 inch.

It is made by Charles H. Besly & Co., Chicago, Ill.

## Boring and Turning Mill

The halftone represents the latest design of boring mill built by the Betts Machine Company, Wilmington, Del. All the movements of the heads on this machine, both vertically and horizontally, are controlled by levers directly on the head; for instance, the head can be moved rapidly any distance along the rail by power, stopped at a given point and the tool adjusted to then cut a given diameter without the operator once leaving the head itself. The feeds also can be thrown in or out instantly from the same point. These movements can also be controlled from either side of the machine. The illustration represents a 7-foot size of mill, but the company manufactures a full line of these machines from 5- to 20- foot swing.



7-FOOT VERTICAL BORING AND TURNING MILL

The mill shown swings 88 inches and takes work 50 inches high under the tools. The table is 7 feet diameter and is driven by an internal gear. The crossrail has a 24-inch face, with a heavy back of box section; it is secured to the face of the uprights by four gibs, two on the inside and two on the outside of the face. The bed is 18 inches deep, which, with a 10-inch depth of table, gives a convenient hight of 28 inches for the top of the table. The uprights have a 10-inch face, are of heavy section and are bolted rigidly to the side of the bed, making a stiff construction. The tops of the uprights are held together by a massive box distance piece.

The machine can be operated either by motor or by belt. The engraving shows the machine motor driven, using for the main drive a 15-horsepower motor, running at from 400 to 1200 revolutions per minute. There are three mechanical changes so that provision is made for a speed variation of 27 to 1, the speeds varying in geometrical progression; that is, as low a speed as 18 feet per minute can be obtained on a seven-foot diameter and as high a speed as 36 feet per minute on a 6-inch diameter. The crossrail is raised and lowered and the heads moved rapidly by means of a constant-speed motor of 42 horsepower, running at 1200 revolutions per minute. This motor is carried on the distance piece between the uprights.

Eight feeds are provided, varying from 1/42 to 1 inch per revolution, the changes being made through positive clutches,

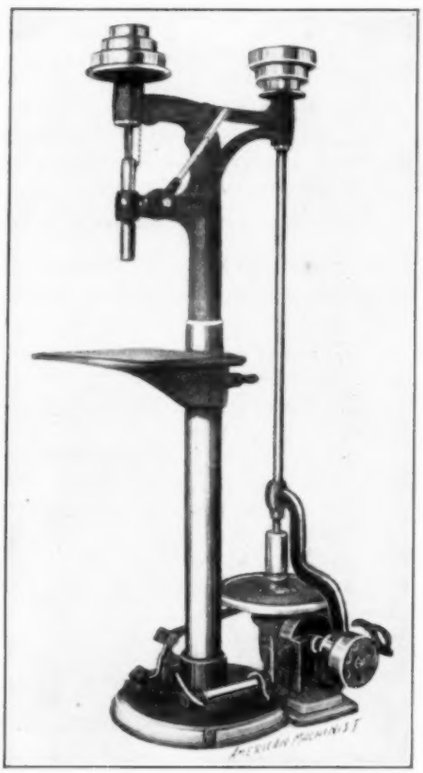
while two rates of rapid travel are provided, namely, 6 feet per minute and 10¼ inches per minute.

All sliding surfaces are of rectangular section. Each tool spindle is separately counterbalanced and so arranged that the weight once hung does not need to be changed for any change in the position of the crossrail or spindle. All shafts are amply large, the bearings are bushed with bronze, and no pinions have less than 14 teeth.

## A Friction Driven Sensitive Drill Press

The halftone shows a new style of drill press which has been brought out by the Barry & Zecher Company, Lancaster, Penn., and is known as their No. 2 drill press.

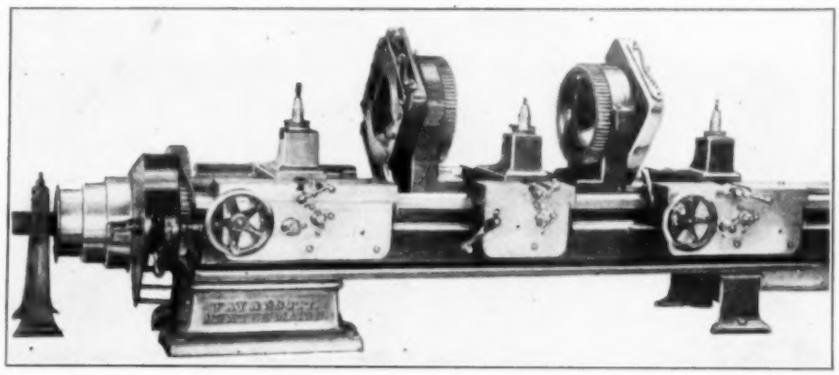
There is but one driving pulley and the drill press can be belted direct to the line shaft. It will be observed that there are two foot levers on the base. The one to the left raises the friction disk off its driver and stops the machine. The treadle to the right controls the position of the driver on the friction disk and consequently the speed of the spindle. The speed can be altered at will with the machine in motion and with the driving pulley making 650 turns per minute, any speed from 250 to 1800 can be obtained at the spindle. The fork on the driving pulley is merely to keep the belt in place when starting and not in any way to act as a shifter. The machine will drill up to 9/16 inch; the greatest distance from spindle to table is 36 inches; from center of spindle to column 13 inches; size of table over oil grooves, 16x13 inches; net weight, 300 pounds.



FRICTION-DRIVEN SENSITIVE DRILL PRESS

## Double End Turning and Facing Lathe

The halftone illustrates a double-end turning and facing lathe, designed and built by Fay & Scott, Dexter, Me., for the Merrimac Iron Foundry, of Lawrence, Mass. This machine is built for squaring up the ends and facing flanges on heavy cast-iron columns, and will handle a maximum length of 22½ feet, diameter of column of 13 inches, diameter of flanges, 32 inches. The two end carriages have power lateral and cross feed, while the middle carriage has power cross feed only. Power is applied to the two chucks or work holders, through a splined shaft running through the center of the bed. On this shaft are mounted two sliding pinions which drive through an intermediate gear to the hollow gear which forms a part of the chuck. The hardened cast-steel jaws of the chucks are operated by two screws worked simultaneously, by means of a connecting chain, and grip the work sufficiently rigid to stand the cutting strains. The changes of carriage feed are obtained by means of a quick-change sliding tumbler gear at the head end of the lathe. The weight of the machine on a 26-foot bed is 12,000 pounds.



DOUBLE-END TURNING AND FACING LATHE

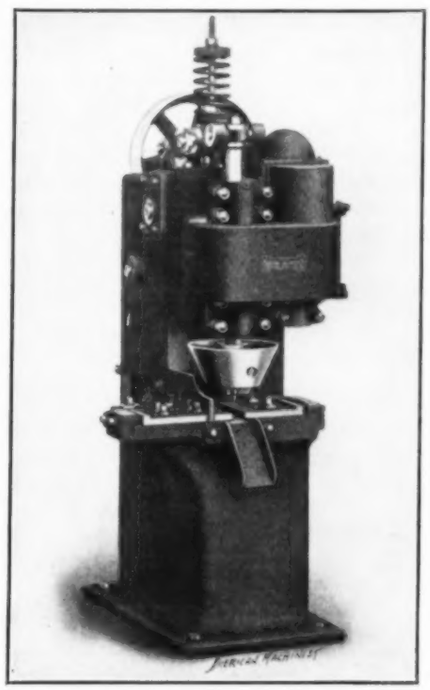
## A Self-Lubricating Bearing Metal

The New Era Manufacturing Company, Kalamazoo, Mich., is putting on the market a metallic packing or self-lubricating bearing metal in the following forms: Bulk; semi-compressed straps; semi-compressed half rings; compressed half rings; compressed divided bushings; compressed openside single-piece bushings; and compressed solid bushings. The metal can be also had to order in special shapes, compressed or semi-compressed.

## Machine for Burring Nuts

The National Machinery Company, Tiffin, Ohio, has a new design of nut-burring or shaving machine for hot-pressed nuts. The operator places the nuts in a slot at the side of the machine and moves them forward; the raising and lowering of the burring spindle and feeding of nuts under the revolving cutters being automatic.

This eliminates all chance of accident to the operator incident to feeding nuts under a rapidly revolving cutter. The finished nuts are ejected from the machine automatically, passing through the chute shown in front.

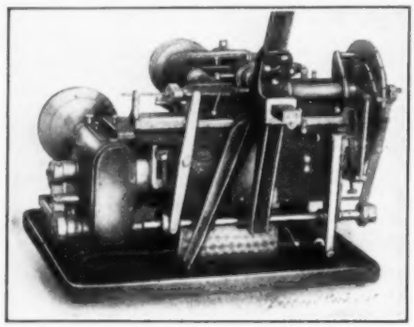


NUT-BURRING MACHINE

This insures from two to four times the production of the hand-feed burring machine and the finish is more uniform as all bur is effectually removed. The cutters are lowered gradually by a cam movement, and there is no tendency for the bur to turn over the edge instead of being cut off. A compensating spring takes care of variations in nut thickness; and safety reliefs are provided both on the burring spindle and feed mechanism. The machine is built in sizes of 1¼- and 2-inch capacity.

## Improved Automatic Pinion Cutting Machine

We illustrate herewith an automatic pinion-cutting machine, built by the Waltham Machine Works, Waltham, Mass., which, while similar in appearance to the machine illustrated some time ago, has been improved so that its output is largely increased. This improvement consists in a magazine feed in place of the hand feed formerly used.



AUTOMATIC PINION-CUTTING MACHINE

## A Tilted Turret Screw Machine

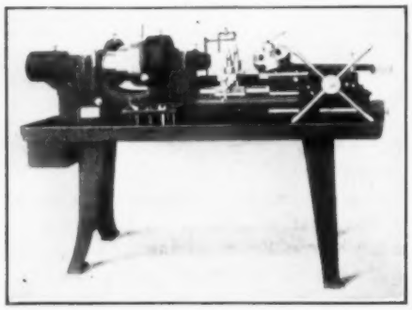
The halftone shows a screw machine with friction-geared head and geared automatic feed to the turret slide, which will handle stock up to 1¼ inches diameter. The head and lower halves of the gear guards are cast integral with the bed.

The cone has three steps for wide belt, and in conjunction with the friction back gears gives six spindle speeds.

The geared automatic feed is from a sprocket on the spindle by chain to a shaft in the bed of the machine and by it six positively driven changes of automatic feed to the turret slide are obtainable.

The automatic bar feed will handle round, square or hexagonal bars.

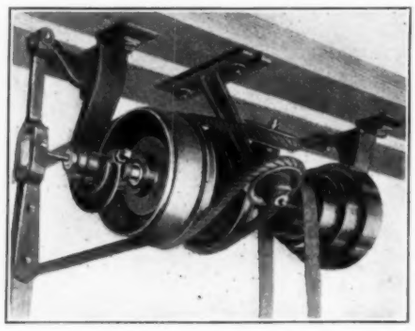
The turret slide is fitted with a taper gib on each side the full length of the saddle, thus providing side adjustment. The saddle is provided with a supplementary tapered base for obtaining vertical alinement of the turret holes. An automatic stop is provided for each hole in the turret. This machine is built by the Wood Turret Machine Company, Brazil, Indiana.



A TILTED-TURRET SCREW MACHINE

## A New Gearless Reversing Countershaft

In the accompanying halftone there is illustrated a reversing countershaft which employs only one driving belt and which is made without gearing. As will be seen, the reverse motion is obtained by means of a grommet spliced, endless rope belt, extending from the driving pulley around two idlers and then to the reversing pulley. Motion in either direction is accomplished by throwing the lever controlling the clutches so that they drive directly; or through the rope belt, in the reverse direction. The idler pulleys are of the self-oiling type and their position is adjustable so as to guide the rope properly on the driving and receiving pulleys and also to give the requisite tightness to the rope belt.

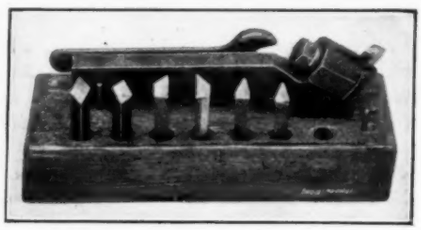


WHEATON GEARLESS, SINGLE-BELT, REVERSING COUNTERSHAFT

It is claimed that the space occupied by this device along the shaft is only 12 inches, or about half that required for most devices designed for the same purpose. All parts are self oiling and of the regular construction adopted by the builders for their ordinary two-pulley countershafts. The advantages claimed for this device are cleanliness, efficiency and compactness. It is manufactured by Carl M. Wheaton, 9 Calendar street, Providence, R. I.

## A Lathe Tool Holder

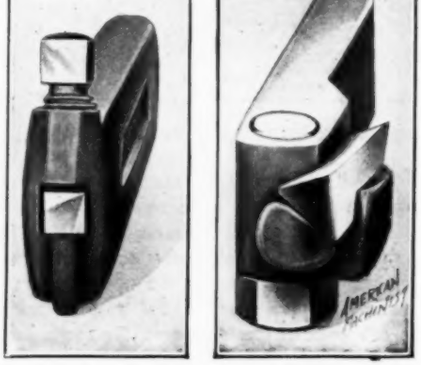
The illustration represents the "Ideal" tool holder which is furnished with seven high-speed steel cutters and a wrench, the tools being ground to shape and numbered. As will be seen the cutter is clamped in such a way as to be gripped on all four sides and the tool can be set to suit various kinds of work; that is, it may be used as a right and left diamond point, right or left offset round nose, right and left side tool, and thread tool, or it may be used for various other tools to suit the operator. The cutters are stock sizes and shapes readily obtained in the bar. The holder is made in three sizes and for extra heavy cuts the two larger sizes have a pin inserted near the bottom of the holder which fits a nick in the cutter to prevent the latter from slipping. The maker is the Lowe Tool and Machine Company, Ansonia, Conn.



LATHE TOOL HOLDER AND SET OF CUTTING TOOLS

## Two Tool Holders

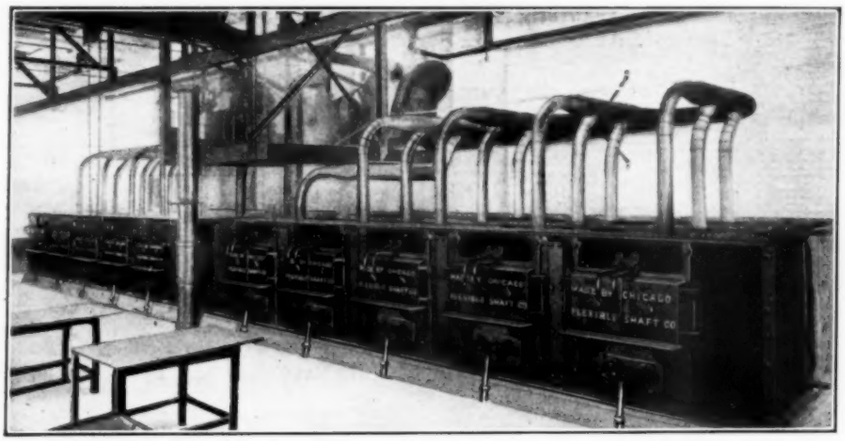
The halftone shows two tool holders which are being put on the market by the G. R. Lang Company, Meadville, Penn. In the one to the left the cutter is made of square section stock and the one to the right uses stock of triangular section. In both these tool holders the cutter is supported at the end by a projection on the body of the holder and they are designed to take cutters of larger section than usual.



TWO NEW TOOL HOLDERS

## Installation of Stewart Furnaces

A new installation of ten Stewart furnaces, in two batteries, at the plant of the Western Electric Company, Hawthorne, Ill., is shown in the accompanying illustration. These furnaces have heating spaces 20x72 inches and burn oil. The oil is delivered by gravity pressure of two pounds from an elevated supply tank. An air blast of 1½ pounds is furnished by a positive blower suspended above. The steel tables are the same level as the furnace floors and the parts, which are brought to the tables in steel boxes on trucks, are pushed directly from the tables into the furnaces. This installation is used for annealing, and other similar ones are used for forging, magnet heating, etc. These furnaces were furnished by the Chicago Flexible Shaft Company, Chicago, Ill.



STEWART FURNACES AT PLANT OF WESTERN ELECTRIC COMPANY

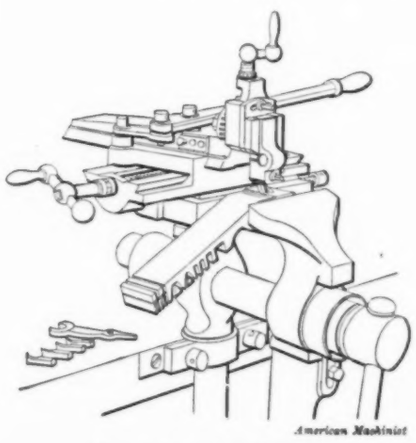
## "Rapide-Lime" Hand Shaping Machine

A novel substitute for, or rather improvement upon, the file and chisel for bench-fitting work, is illustrated in the accompanying halftone. This takes the form of a hand shaping machine which is clamped to one jaw of the vise, while the other jaw clamps the work against the bed. The advantage of such a device when considerable metal needs to be removed and all the shapers are busy on regular work, is apparent.

The tool head has a longitudinal movement of 10 inches, and a transverse travel of 7¼ inches. It is claimed that with this machine a depth of cut of ⅛ inch is possible in steel. The tool head is graduated and adjustable for planing vertical and inclined surfaces. The cutters used are cut out of steel bars, without any subsequent forging. The shape of the cutting edge is at once obtained on the grindstone.

It is also possible to clamp the bed to the table of any machine tool, or an accessory table may be furnished to bolt to the bench, where convenient, making a self-contained and complete machine. The transverse feed screw has a divided head and the feed may be by hand or automatic, in either direction. The weight is 40 pounds; with table, 77 pounds.

While this machine is made in Europe, where it is said over 20,000 are in use, it is for sale in this country by the New Metal Tool Steel Company and Standish Tool Works, Portland, Maine, having a New York office at 95 Cliff street.



HAND SHAPING MACHINE

## An Automatic Saw Swage and Shaper

The halftone, Fig. 1, shows a new automatic saw swage and shaper which has been put on the market by the Covel Automatic Saw Swage and Manufacturing Company, Birmingham, Ala. Fig. 2 shows the details of the machine. *A* is a section of the band saw resting on the adjustable support *B*. The teeth are swaged by means of three rollers, the first spreading the metal from the center of the blade, the next spreading a little more, and the last, a straight roller, finishes the work and the saw feeds automatically to the next tooth. The shaper is operated by an eccentric, the shaping being done at the same time a tooth is being swaged.

The machine is usually set up back of the saw sharpener on a line with the saw, and belted from a shaft below the floor. The speed of the machine is the same as that of the sharpener, permitting them to be operated together. As soon as the first swaged and shaped tooth reaches the sharpener, the three operations go on simultaneously.

The machine weighs complete, 180 pounds.

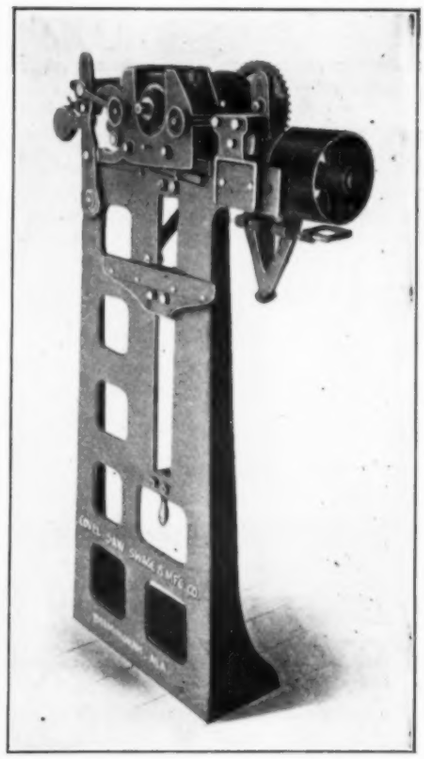


FIG. 1. AN AUTOMATIC SAW SWAGE AND SHAPER

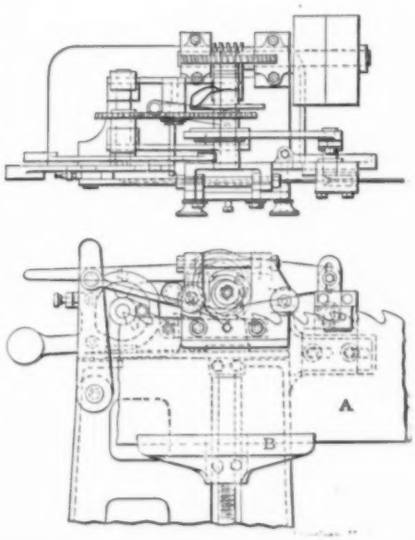



FIG. 2. DETAILS OF THE MACHINE

# Industrial Education the Keynote of Advancement

That there is an unmistakable movement for the better training of apprentices or young mechanics is seen on every hand. A very striking evidence of the way this is appealing to machine-tool builders is shown in the following quotation from a letter of B. B. Quillen, president of the Cincinnati Planer Company, who is largely responsible for the Cincinnati continuation plan and its success:

As machine-tool builders we should encourage industrial education, assisting the trade schools and technical schools, wherever possible. The Coöperative Engineering School as originated by Prof. Herman Schneider, of this city, the Cincinnati Continuation School and similar institutions throughout the country are all doing splendid work in this direction. There is nothing that tends more to raise the standard of our product and lessen labor troubles than education. The more education a man has the greater his desire to live better and work better. It creates a pride in him. He wants his wife to make a good appearance; he wants his children to go to school; he wants them both to have some amusement.

To realize this ambition he wants steady work, he wants good wages and in return is willing to give a faithful and intelligent day's work. Show me a man like this, and I will show you one who has no desire to shirk. The unsatisfactory employee is the ignoramus, the morally weak, the degenerate, the man whose wife is a mere slave, whose children do not go to school, whose family live in one room, who know no comforts, no amusements, no words of encouragement, who give us low production and poor quality. Educate the employee, and the mechanical world will advance proportionately.

# Increasing Shop Capacities

## Where More Tools Will be Needed

J. P. Lund will erect a $20,000 sawmill at Nelson, Minn.

Slack Brothers will build a sugar refinery at Rosedale, La.

Thos. Alery will build a tannery and glove factory at Merrill, Wis.

Fred and Harry Johnson will erect a sawmill at Dexter, Ore.

H. H. McClean, of Walla Walla, Wash., will erect a flour mill.

Otto Erickson, Chisholm, Minn., will build a blacksmith shop 50x85.

The Kokomo (Ind.) Brass Works is to erect an addition to its foundry.

The Winona (Minn.) Candy Company will erect a four-story addition.

The Milwaukee (Wis.) Machine Tool Company will erect a new plant.

The Round Lake Shingle Company will build a new mill at Innis, La.

The Rutland Railroad will build a new roundhouse at Bennington, Vt.

The Waite Grass Carpet Company, Oshkosh, Wis., will build a new factory.

The Utter Pipe Company, Olean, N. Y., is erecting an addition to its plant.

The Kewanee (Ill.) Boiler Company is erecting additions to its plant.

The Fleck Furniture Company, Milwaukee, Wis., will erect a new building.

M. H. Lang, 119 Fifth street, S. E., Minneapolis, Minn., will erect a garage.

The Foley-Rieger Paper Company is to build a paper mill at Thorold, Ont.

The Seekonk Lace Company, Pawtucket, R. I., is building a $10,000 factory.

The Eller Wagon Works, Houston, Tex., is to erect a new three-story factory.

D. A. Morrison and others will erect a cement plant at Three Forks, Mont.

J. O. Fredenburg will rebuild the Crown Roller Mills, at Alexandria, Minn.

C. W. Howard, of Spokane, Wash., is planning the erection of a paper mill.

The plant of the Eagle Tile Works, Eagle Grove, Iowa, was destroyed by fire.

The plant of the Christy Knife Company, Fremont, Ohio, was destroyed by fire.

The Milwaukee Lumber Company will erect a new sawmill at St. Maries, Idaho.

The Northern Paper Mills, Green Bay, Wis., will erect an addition to cost $100,000.

The Quilcene (Wash.) Packing Company will erect a cannery in the near future.

The roundhouse of the Santa Fe Railroad at Wellington, Kan., is to be enlarged.

A. Pardee & Co., Hazleton, Penn., will construct a large flour and feed warehouse.

The National Condensed Milk Company, New London, Wis., will enlarge its plant.

The Trenton (N. J.) Bone Fertilizer Company will build an addition to its plant.

The Little Rock (Ark.) Handle Company has obtained a permit to erect a factory.

The F. H. McKay Company, Vancouver, B. C., will erect a sash and door factory.

F. A. Patrick, Duluth, Minn., will build an auto garage in the rear of his warehouse.

Michael Majerns, 616 Fifth street, N., Minneapolis, Minn., will erect a $12,000 garage.

The Sheboygan (Wis.) Evaporated Milk Company is to erect a plant in Jefferson, Wis.

The plant of the Raymond (Wash.) Foundry and Machine Company will be enlarged.

It is reported the Stack Gibbs Lumber Company will erect a mill at La Crosse, Ida.

A. J. Linville contemplates the erection of a concrete tile factory at Wenatchee, Wash.

The Columbus (Ohio) Screw and Machine Company will move its plant to Newark, O.

The New York Central Railroad is to erect a $80,000 car-shop building at Oswego, N. Y.

The Wisconsin Chair Company will build an addition to its plant at Port Washington, Wis.

The International Rubber Company will establish a plant at Bay Spring, Barrington, R. I.

J. P. and Clyde Graves, of Spokane, Wash., are interested in the establishment of a paper mill.

Work will soon be started on a factory building for the Charlton Mills, Fall River, Mass.

The council at Keewatin, Minn., is considering the installation of an electric-light plant.

The Peoria (Ill.) Drill and Seeder Company will erect a one-story addition to cost $15,000.

The sawmill of the Holt (Wis.) Lumber Company was destroyed by fire. Loss, $20,000.

The Crown Electrical Company, St. Charles, Ill., will establish a branch plant at Brantford, Ont.

The Bellingham Bay Lumber Company, Bellingham, Wash., will double the capacity of its mill.

The Franklin (Mass.) Yarn Company is building an addition and will install a new boiler, etc.

The Perfect Fireless Cooker Company, of Minneapolis, will establish a plant at Stillwater, Minn.

Wilkinson, Gaddis & Co., Newark, N. J., is to build a new mill and elevator to cost about $40,000.

The Standard Electric Time Company, of Waterbury, Conn., will move its plant to Foxboro, Mass.

A $10,000 addition will be erected at the plant of the Wisconsin Foundry Company, Milwaukee, Wis.

The Buckeye Stamping Company, of Columbus, Ohio, has purchased site for a new and larger plant.

The Buffalo (N. Y.) Union Furnace Company is erecting an addition to be used as a testing laboratory.

The Mystic Process Leather Company, of Medford, Mass., is said to be considering the removal of its plant.

The Empson Packing Company, of Longmont, Colo., is looking for suitable site for its canning factory.

The A. H. Fox Gun Company, Philadelphia, Penn., is considering locating its plant in some other locality.

The Schaefer Brothers Building Supply Company, St. Louis, Mo., is to erect a new $25,000 planing mill.

Extensive improvements are contemplated at the municipal electric-light and water plant at Franklin, La.

Cote & Henderson, Ballard, Station, Seattle, Wash., will erect a shingle and lathe mill at Oxboro, Wash.

Work has been started on a three-story addition at the plant of the Atlas Tack Company, Fairhaven, Mass.

Estimates are now being received for the new plant of the Victor Safe and Lock Company, at Norwood, Ohio.

The Inman Paper Box Company, Kalamazoo, Mich., is considering the erection of a new and larger plant.

The Johnstown (Penn.) Planing Mill Company, whose plant was burned recently, will rebuild on a larger scale.

The Lon de Van Mining Company, of Juneau, Alaska, will install a power plant at a mine on Georges Inlet.

Contracts for the erection of the Lozier Motor Company's new factory at Detroit, Mich., have been awarded.

I. Newman & Sons, New Haven, Conn., have awarded contract for the erection of an addition to their boiler house.

The city of South Norwalk, Conn., has appropriated $30,000 for an addition to the municipal electric-light plant.

The plant of the Chesapeake Basket Company, at Chesapeake City, Md., was destroyed by fire. Loss, about $10,000.

The plant of the Pennsylvania Dye and Bleach Works, Pottstown, Penn., was destroyed by fire. Loss, $10,000.

The plant of the Manville Covering Company, Providence, R. I., was damaged by fire to the extent of about $20,000.

The Wilkins Box Company, Amsterdam, N. Y., is looking for another location for establishing a modern factory.

The Herbeck-Demer Company, Honesdale, Penn., manufacturing cut glass, will establish a new plant in the near future.

The Girard (Ohio) Iron Company will immediately rebuild its blacksmith, machine and carpenter shops recently burned.

A one-story power house is being erected at the plant of Baker & Co., 412 New Jersey Railroad avenue, Newark, N. J.

The Tudhope Motor Company, Ltd., Orillia, Ont., recently formed to manufacture automobiles, is erecting a factory.

The car shops of the New York Central Railroad at Depew, N. Y., were damaged by fire to the extent of $400,000.

The East River Lumber and Fuel Company expects to install new machinery at its planing mill at Green Bay, Wis.

Bloomquist Brothers, Seattle, Wash., have secured a building and will install machinery for making sash, doors, furniture.

The Perkins Iron Foundry and the Le Baron Foundry, at East Bridgewater, Mass., were burned. Loss, about $75,000.

Work has been started on a new building at West Gloucester, Mass., for the Burroughs Nut and Bolt Company, of Boston.

The Page & Lyon Manufacturing Company, New London, Wis., manufacturing lumber and beehive supplies, will enlarge its plant.

The plant of the Bay Minette Shingle Company, at Bay Minette, Ala., was destroyed by fire, causing a loss of about $10,000.

The Homestake mine, at Neal, Idaho, will have a mill erected to handle 75 tons of ore daily. Frank B. Donovan, superintendent.

The paper mill of the Vandecar Paper Company, at Schodack, N. Y., recently destroyed by fire, will be rebuilt immediately.

The Dover Land Company, of Providence, R. I., is contemplating the installation of a gas engine in its manufacturing building.

A two-story addition to be used as a machine shop will be erected at the plant of the Adams Husker Company, Marysville, Ohio.

The Ashworth & Odell Worsted Mill Company, of Jamestown, N. Y., has awarded contract for the erection of a plant at Salamanca.

Plans are being drawn for a new dye house and bleachery for the Merino plant of the Joslin Manufacturing Company, Providence, R. I.

The Crown Metal Furniture Company, Jamestown, N. Y., will double its capital and erect a new factory to be four or five stories high.

The Van Brunt Manufacturing Company, Horicon, Wis., manufacturing seeders, will build a three-story addition, also blacksmith shop.

The United Clay Companies will construct a large warehouse in Jersey City, N. J. The company has plants in Akron and Tallmage, Ohio.

The Williams Cypress Company, Patterson, La., will install an electric-haulage system and also contemplate furnishing light for the town.

John Stirlin, Kansas City, Mo., manufacturer of electric batteries, is said to be considering inducements for the removal of his plant.

It is stated the Frenier Automobile Company, of Rutland, Vt., is looking for suitable site for establishing a large and modern plant.

The Oswegatchie Manufacturing Company, Buffalo, N. Y., has commenced the erection of a four-story addition to its silk-manuacturing plant.

The Hamburg (Penn.) Manufacturing Company is looking for site on which to erect new plant for the manufacture of chain hoists.

The Dill Manufacturing Company, 5915 Bonna avenue, Cleveland, Ohio, is in the market for a reclining power press, 1½ inch stroke.

Fuerst & Kraemer will build an ice-cream and candy factory in New Orleans, La., which, it is said, will be the largest in the South.

The Hess-Snyder Company, of Massillon, Ohio, is seeking another location. The concern manufactures furnaces, steel ranges, pulleys.

Chas. H. Stehling Company, Milwaukee, Wis., building tanners' machinery, will erect a new $30,000 factory at Fourth and Poplar streets.

H. W. Haupisch, manager of the Corvallis Creamery Company, of Lebanon, Ore., contemplates the establishment of another creamery.

The Sherwin-Williams Company, Cleveland, Ohio, manufacturing paints, is considering the establishment of a branch plant in the Northwest.

The Capital Gasoline Engine Works, of Wrightsville, Penn., is to move to Lancaster, Penn. Plans for new buildings are now being prepared.

The Frederick (Okla.) Knitting Mill, recently organized, has awarded contract for the erection of a building to be equipped with hosiery knitters.

The Dielectric Company of America, Belleville, N. J., is in the market for a new or second-hand wire-testing machine of 10,000 pounds capacity.

Wayne Armstrong is at the head of a company being organized at Laurelville, Ohio, for the manufacture of automobiles. Capital, will be $150,000.

Harvey Chalmers & Sons, Amsterdam, N. Y., button manufacturers, are said to be looking for a site in the South to establish a branch factory.

The Lancaster (Penn.) Foundry Company is erecting a new foundry at North Lancaster, to be devoted especially to high-grade light gray-iron castings.

Thos. F. Ahern, 303 Hancock avenue west, Detroit, Mich., is said to be interested in the establishment of a new automobile factory in the Cenral West.

The Lake Shore & Michigan Southern Railroad will build new big car shops at Toledo, Ohio. It is said about $5,000,000 is to be spent at this point.

The Manhattan Fire Proof Door Company, 412 East One Hundred Twenty-fifth street, New York, will build a factory at Winfield, L. I., to cost $500,000.

The Wason Manufacturing Company, Springfield, Mass., is to make improvements at its car-building plant. A new foundry building will be erected.

Theodore Swann, who secured contract to furnish electric lights to the city of Bristol, Tenn., will spend $500,000 in the development of a power plant.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., May 28, for furnishing cross and switch ties as per Circular No. 579.

George W. Hammers, of Colorado Springs, Colo., who has invented a new steam plow, is interested in the organization of a company to manufacture same.

It is said the Pennsylvania Railroad has appropriated $100,000 for improvements at its shops in Renova, Penn., including an addition to the boiler shop.

M. M. Morris, of the Harlan-Morris Manufacturing Company, Trenton, Tenn., is considering plans for the erection of new woodworking and finishing plants.

The Superior Motor Vehicle Company, Buffalo, N. Y., has broken ground for its new plant at 1086 Elmwood avenue. About 200 men will be employed.

A. A. Ackerman and W. C. Hathaway, of Sioux City, Ia., have organized the Watertown Steel Tank Company and plant will be erected at Watertown, S. D.

The Russell Uniform Stave Company, Memphis, Tenn., with a capital of $50,000, is to ask for a charter and will erect a plant for producing 60,000 staves daily.

Plans are being prepared for a two-story addition to the plant of the Timken Roller Bearing Company, Canton, Ohio, to be used as a furnace and annealing room.

Vernon Walker, of Akron, Ohio, is interested in the new Dunham Nutlock and Bolt Company, recently formed, and is seeking site on which to establish its plant.

The Neptune Ice Company, 100 William street, New York, will erect a 200-ton ice plant at Neptune avenue and Twenty-third street, Coney Island, to cost $75,000.

The Wichita Motor Car Company is being organized at Wichita, Kan., by A. N. Jones, to manufacture the Wichita automobile invented by D. N. Baxter, of that place.

The plant of the Baldwin Forging and Tool Company, of Columbus, Ohio, will be moved to Charleston, W. Va. The concern employs between 800 and 1000 hands.

The Kempsmith Manufacturing Company, of Milwaukee, Wis., has purchased site at West Allis, and will erect a $150,000 plant for the manufacture of its machine tools.

The Southworth Machine Company, Portland, Me., has awarded contract for the construction of a three-story factory. The ground floor will be fitted up as a garage.

The Gas Traction Company, Minneapolis, Minn., is planning extensive improvements, including a new foundry to cost about $60,000, an addition to plant to cost over $12,000, etc.

The Emerson Typewriter Company has just completed the erection of a new plant at

Woodstock, Ill. This occupies a space of 35,000 feet and the output will be about 60 machines daily.

The Isthmian Canal Commission, Washington, D. C., will receive bids until 10:30 a.m., May 20, for dynamite, blasting caps, fuses, insulating tape, connecting and lead wire as per Circular No. 580.

The Wehr Steel Company, recently organized, has secured site at West Allis, Wis., and will erect a $50,000 plant for the manufacture of crucible-steel castings. Eight oil furnaces will be installed.

Sealed proposals will be received until 12 o'clock noon, May 20, for furnishing electric-light system at Fort Missoula, Mont. Information can be had of Major A. B. Shattuck, constructing quartermaster.

The Universal Motor Company, of Denver, Colo., is looking for a suitable location in the Central West for the erection of a plant to manufacture automobiles, which will eventually employ about 1200 hands.

Sealed proposals will be received unti 1:30 p.m., May 23, for the construction of electric-lighting system at Fort Morgan, Ala. Information can be had of Capt. H. B. Chamberlain, constructing quartermaster.

Sealed proposals will be received at the office of the engineer, Third Light House District, Tompkinsville, N. Y., until May 10, for one universal milling machine and one 24-inch upright sliding-head drill, motor driven.

H. O. Peck and others interested in the H. O. Peck Automobile Company, 181 East Water street, Portland, Ore., are looking for suitable site to establish their plant for the manufacture of spring wheels for auomobiles.

The United States Heat and Lighting Company has awarded contract to Snyder & Gillette, Niagara Falls, N. Y., for building its proposed plant in the north end of the city. It is said this will employ between 500 and 1000 hands.

Sealed proposals will be received until 3 p.m., May 25, for furnishing and installing electric power plant and electric-lighting system at Fort Caswell, N. C. Information can be had of First-Lieut. W. R. McCleary, constructing quartermaster.

The Seneca Chain Company, of Kent, O., is said to be considering the erection of a new and modern plant to replace the one recently burned, if suitable site can be obtained where citizens will offer some financial inducements. Would employ about 300 men.

Proposals will be received until 3 p.m., June 13 at the office of Supervising Architect, Treasury Department, Washington, D. C., for the installation of a new high-pressure steam boiler plant and accessories for the United States court house and Postoffice building, Pittsburg, Penn.

Fire destroyed the stone-working plant of Shea & Donnelly, also laundry plant of the New England Laundry Company, and the factories of the Gem Leather Company and Lyons & Hershendon, leather manufacturers, on Harbor street, Lynn, Mass., causing a loss of over $100,000.

Sealed proposals will be received at the Augusta Arsenal, Augusta, Ga., until 10 a.m., May 16, for furnishing during the year ending June 30, 1911, the following material: Brass nails, screws, rivets, nuts, oils, paints, hardware, etc. Further information can be had of the commanding officer.

The Campbell, Wyant & Cannon Foundry Company, Muskegon, Mich., which recently acquired the Enterprise Foundry Company, will install new equipment, including molding machines, exhaust mills, air compressor, ladles, sand mixer, electric driven elevator, 5000-pound transverse machine, etc.

The Simonds Manufacturing Company, of Fitchburg, Chicago and Montreal, announces the completion of plans for the erection of a new steel mill at Lockport, N. Y. The initial investment will be about $225,000. The company manufactures saws, machine knives, crucible sheet steel, files, hacksaws.

The Victor Iron Works Company, 523 Schofield building, Cleveland, Ohio, recently reported incorporated, will erect some time in the future, foundry, drop-forge plant and machine shop. At present work is being done in leased shops. The company manufactures automobile parts, machinery, drop forgings, castings.

Sealed proposals will be received at the office of the constructing quartermaster, Fort Dupont, Delaware City, Del., until 11 a.m., May 23, for two 75-horsepower water-tube boilers, one feed-water heater, one feed pump, new steam and exhaust mains. Plans and information can be obtained of the quartermaster.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., May 26, for hand cars, push cars, warehouse trucks, wheelbarrows, jacks, anvils, vises, forges, picks, hammers, drills, pipe tools, shears, belt punches, differential snatch and tackle blocks, valves, pipe, fittings, etc., as per Circular No. 578.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., May 11, for locomotive cranes, inspection car, chain blocks, axes, adzes, locks, hinges, vacuum gages, foot valves, cocks, pipe fittings, screws, rivets, nails, saws, twist drills, corundum wheels, rubber belting, etc., as per Circular No. 577.

A large new coke plant will be built at South Bethlehem, Penn., for the purpose of supplying the Bethlehem Steel Company with coke. This is to be operated by German specialists, represented by Fred Mayer, 50 Church street, New York. The plant will produce primarily about 3000 tons per day.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: May 10—190,600 pounds of structural steel (schedule 2429), 24 induction motors, oil-cooled transformers, cable (schedule 2427), 400 mercury vapor lamps (schedule 2425), truing devices, portable electric drills (schedule 2434), radial electric drills, electric hand drills (schedule 2431), gasolene engine (schedule 2433).

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., June 15, for furnishing and erecting 46 mitering lock gates for two leaves each and of certain fixed parts for same and for furnishing certain repair parts, as per Circular No. 576. The material required includes 44,351,080 pounds riveted structural steel, 464,240 pounds of turned-steel bolts and nuts, 506,080 pounds of nickel-steel pins for yoke and bearing plates, 307,840 pounds manhole and man-shaft covers, 3,233,040 pounds of carbon-steel castings, 92,280 pounds of cast-iron guards in foot walks, 124,000 pounds vanadium-steel upper pintle castings, 14,000 pounds bronze pintle bushings, 125,600 pounds of hand railings complete, 144,240 pounds of piping, valve rods and connects, 6000 pounds of valves and stuffing boxes, 165,360 pounds of babbitt metal under nickel-steel bearing plates, complete pumping system.

## NEW INCORPORATIONS

Eureka Worsted Mills Company, Cleveland, Ohio. Capital, $100,000. Incorporators, Edward P. Day, M. J. Flanigan, B. Kenollek, etc.

Schneider Brick Company, Columbus, Ohio. Manufacture brick, tile, etc. Capital, $25,000. Incorporators, C. W. Schneider, J. C. Schneider, etc.

Federal Button Company, Newark, N. J. Manufacture buttons, etc. Capital, $100,000. Incorporators, P. J. Duggan, M. M. Henschel, S. Zimmerman.

Martine Motor Car Company, Westfield, N. J. Manufacture automobiles, bicycles, etc. Capital, $25,000. Incorporators, L. D. Darby, G. W. Frederick, H. C. Darby.

Canton Clay Products Company, Canton, Ohio. Manufacture tile, etc. Capital, $50,000. Incorporators, F. P. De La Mater, H. G. Winterhalter, A. G. File, etc.

Hugo Manufacturing Company, Chicago, Ill. Manufacture vacuum cleaners, etc. Capital, $100,000. Incorporators, Geo. A. Hubert, W. L. Groth, Edgar J. Cook.

Benefit Steel Furnace Company, Cincinnati, Ohio. Manufacture steel and other furnaces. Capital, $10,000. Incorporators, H. M. Freeman, J. Y. Chadwick, etc.

Jackson Center Concrete Tile and Construction Company, Jackson Center, Ohio. Capital, $10,000. Incorporators, Michael Zwield, F. C. Allenbach, H. Schueler, etc.

New Process Machinery Company, Newark, N. J. Manufacture machinery, etc. Capital, $100,000. Incorporators, E. L. Quackenbush, Edw. O. Stanley, Jr., Geo. W. Perry.

Century Iron and Steel Company, Buffalo, N. Y. Manufacture and deal in iron, steel, copper, etc. Capital, $10,000. Incorporators, Wm. J. Wark, Earl Thilien, Emil Hector.

De Rosa Horseshoe Company, Schenectady, N. Y. Manufacture and deal in horseshoes, etc. Capital, $10,000. Incorporators, M. De Rosa, Rosario Cascio, Joseph Sangiovanni.

Bean Spray Pump Company, Cleveland, Ohio Manufacture and sell agricultural implements. Capital, $75,000. Incorporators, E. A. Williams, J. W. Smith, E. B. Southwick, etc.

Strickland Vacuum Cleaning Machine Company, New York. Manufacture and deal in vacuum-cleaning machinery. Capital, $50,000. Incorporators, E. S. Strickland, J. H. Weber, J. F. Pitz.

Simonton Construction Company, Columbus, Ohio. Manufacture elctrical apparatus and machines. Capital, $10,000. Incorporators, R. Simonton, T. M. Sherman, N. M. Carpenter, etc.

Automatic Sprinkler Company of America, Trenton, N. J. Manufacture devices, machinery, etc. Capital, $2,000,000. Incorporators, Wm. H. Randel, Peter B. Olney, Jr., Edwin Vandewater.

Active Specialty Company, Camden, N. J. Mechanical and electrical engineers, machinists, metalworkers, etc. Capital, $50,000. Incorporators, John A. Barry, Frank M. Kegrize, Lewis T. Condon.

Rinek Aëro Manufacturing Company, Phillipsburg, N. J. Manufacture aëroplanes, etc. Capital, $50,000. Incorporators, H. Rinek, C. N. Rinek, F. R. Buckman, of Easton, Penn.; S. C. Smith, Phillipsburg.

Disbrow Cordage Company, New York. Manufacture and deal in cordage of all kinds. Capital, $15,000. Incorporators, Herman G. Disbrow, Morristown, N. J.; H. Grinnell Disbrow, Geo. W. Schenck, 103 Reade street, New York.

The Anthony Company, New York. Tool and boilermakers, brass founders, civil, mechanical and electrical engineers. Capital, $350,000. Incorporators, N. W. Anthony, A. R. Anthony, 45 West Thirty-fourth street; David C. Munson, 34 Nassau street.

Revolving Door and Fixture Company, New York. Manufacture and deal in revolving doors, hardware and supplies. Capital, $120,000. Incorporators, Edgar T. Ely, 98 Wilson avenue, Flushing, L. I.; T. C. Riegelman, 43 Lee avenue, Brooklyn; R. S. Du Bois, 23 Vandewater street, New York.

## BUSINESS ITEMS

After May 1 the Cleveland Twist Drill Company will move its Chicago branch to 9 North Jefferson street.

The National-Acme Manufacturing Company, Cleveland, Ohio, has opened an office at Detroit, Mich., in the Majestic building. This office will be in charge of E. G. Matter, who has been with the company for a number of years in the Ohio and Chicago territories.

Announcement is made by E. S. Jackman & Co., agents for the Firth-Sterling Steel Company, that A. E. Barker has been transferred from the Chicago headquarters to Birmingham, Ala., which will enable him to give his entire time to wants customers in the States of Alabama, Mississippi, Louisiana and Tennessee.

## TRADE CATALOGS

Butterfield & Co., Derby Line, Vt. Catalog of screw plates, taps, dies and reamers. Illustrated, 90 pages, 6x9 inches, paper.

The Ready Tool Company, Bridgeport, Conn. Catalog describing Red-E tool holders. Illustrated, 14 pages, 4x6½ inches, paper.

The Queen City Machine Tool Company, Cincinnati, Ohio. Catalog of back-geared crank shapers. Illustrated, 6x9 inches, paper.

Jos. H. Whitehead Company, 30 South Canal street, Chicago, Ill. Catalog of machinists, mill and railway supplies. Illustrated, 428 pages, 4½x7 inches, paper.

The Waterhouse Company, 6-16 Pelham street, Boston, Mass. Catalog describing portable autogenous welding equipment. Illustrated, 12 pages, 6x9 inches, paper.

Samuel Harris & Co., 114-116 North Clinton street, Chicago, Ill. Catalog of hacksaws, wrenches, nuts, ladies, supplies. Illustrated, 510 pages, 3½x5½ inches, paper.

## FORTHCOMING MEETINGS

National Association of Manufacturers, annual meeting, Waldorf-Astoria hotel, May 16, 17 and 18, 1910. Geo. S. Boudinot, secretary, 170 Broadway, New York City.

National Machine Tool Builders' Association, spring convention, May 24-25, Rochester, N. Y. Charles E. Hildreth, Worcester, Mass., secretary.

American Society of Mechanical Engineers, spring meetings, Atlantic City, N. J., May 31-June 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Strittmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

## WANT ADVERTISEMENTS

*Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.*

### Miscellaneous Wants

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Machinery to order, or will purchase good patents. Interstate Machinery Co., Troy, N. Y.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Foundry with first-class machine shop and exceptional facilities desires to contract for manufacturing machines or devices of gray iron. Box 419, AMERICAN MACHINIST.

Mechanical engineer wants to correspond with firms desiring to build pumps, compressors and engines of new designs and of exceptional merits. Box 460, AMER. MACH.

Wanted—To know of good plant, having machinery for manufacturing automobile motors in large quantity; want a live concern with plenty of equipment. Auto., AM. M.

A well equipped machine shop within 30 miles from New York solicits orders for all kinds of machine work. Send inquiries: The Brunswick Refrigerating Co., New Brunswick, N. J.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

We desire to have some responsible and progressive machine shop to manufacture a new perfected and patented device in the machine tool line that will show an increased capacity of fully 20 per cent. of a large number of tools now in use. Box 478, AM. MA.

Proposals for ordnance supplies. Watervliet Arsenal, Watervliet, N. Y., April 16, 1910: Sealed proposals, in triplicate, will be received until 1 p.m., May 16, 1910, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1911. Information furnished on application. Lieut.-Col. W. W. Gibson, Commander.

### Help Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Petersboro, Ont.

CONNECTICUT

Wanted—Draftsmen on automatic machinery; state age, experience and wages expected. Box 479, AMERICAN MACHINIST.

Working foreman experienced in work of high accuracy, on automatic screw machines, milling and grinding; state age, experience, salary and references. Box 452, AM. MACH.

Wanted—A foreman skilled in assembling of adding machines and understanding fully all requirements and refinements of this work; only men of ability who can present unquestionable proof of their capacity and personal character will be considered for this position; to a satisfactory man a permanent position offering large responsibilities is opened; the factory is well located in the East and is a modern building with new equipment throughout; all replies will be considered absolutely confidential, but should contain as complete information as possible of age, past experience and references. Box 471, AMERICAN MACHINIST.

ILLINOIS

Wanted — Draftsman, experienced on fine automatic machinery; give age, nationality, experience, education and salary expected; only first-class man need apply. Box 472, AMERICAN MACHINIST.

The board of education of Chicago require teachers in the following departments: (a) blacksmithing; (b) foundry; (c) machine shop; (d) woodworking; (e) electrical construction; (f) mechanical drawing; minimum requirements: The equivalent of a high school education and three years' work in his line; examinations, June 27-28, 1910. For blanks and further information, apply to the Department of Examinations, 829 Tribune Bldg., Chicago.

INDIANA

Wanted—First-class screw and turret lathe foreman; must be competent in uptodate methods and capable of getting results. Nordyke & Marmon Co., Indianapolis, Ind.

Wanted—Machinists, we are continually increasing our force; we invite applications from lathe and floor hands, those who desire a steady position. Apply at Wood Turret Machine Co., Brazil, Ind.

MASSACHUSETTS

First-class toolmaker; must be a hustler, used to jig work and short cuts. Box 433, AMERICAN MACHINIST.

Expert day operators on 2" to 6" Cleveland automatic screw machines on forming work; foreman of night lathe and gear-cutting departments; Gleason bevel gear operators. Boston Gear Works, Norfolk Downs, Mass.

MICHIGAN

Wanted—Toolmakers, die sinkers, lathe hands, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—First-class machine shop foremen; must be accurate and producers. Address Seager Engine Works, Lansing, Mich.

Wanted—Immediately, first-class machinists and diemakers; good wages, steady employment. Michigan Machinery Mfg. Co., Ypsilanti, Mich.

Wanted—Draftsman, experienced general and detail designer heavy machinery; good wages; steady employment with firm located in city of Detroit; state experience. Address P. O. Box 582, Detroit, Mich.

Machinists, Etc., Wanted—25 first-class Browne & Sharp and National-Acme automatic screw machine operators; machinists and lathe hands; A-1 men only need apply. Buick Motor Co., Flint, Mich.

Wanted—One of the oldest and best established companies in the Middle West seek the services of a general foreman for their machine shop; about 350 are employed in the department, and building and equipment are thoroughly modern; the nature of the work varies from a line similar to automobiles and manufactured in large quantities, to a medium heavy plain class of railway equipment; none but high grade men apply, as the position is an important one and requires a man of broad experience. Box 415, AM. MACH.

MINNESOTA

**Wanted—Superintendent for implement factory in Minnesota; man with knowledge of drafting and pattern making preferred. Box 481, AMERICAN MACHINIST.**

MISSOURI

**Wanted—Experienced draftsman; good on designing jigs and fixtures; one capable also of laying out small experimental work, such as desired in adding machine construction; state fully, experience and salary desired. Dalton Adding Machine Company, Poplar Bluff, Mo.**

NEBRASKA

**First-class automobile machinists and toolmakers. Apply to C. M. Mohler, Ralston, Neb.**

NEW JERSEY

**Wanted—Foreman for cock department, making full line brass and iron cocks for steam, water and gas. Address, stating experience and wages, P. O. Box 2026, Paterson, N. J.**

**Mechanical Draftsman—Large manufacturing company located in vicinity of New York City requires several high-class designers of special automatic labor-saving machinery; give full details and qualifications. Box 449, AMERICAN MACHINIST.**

**Wanted—Assistant foreman, grey iron foundry, fittings and valves for steam, water and gas; must have good experience in molding machine practice and green sand cores. Address, stating experience and wages, P. O. Box 2026, Paterson, N. J.**

**Wanted—Machinists; steady work for good milling, boring, lathe and floor hands; also tool and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia).**

NEW YORK

**Wanted—An experienced layerout for bridge and structural shop in the Far East; state experience. Box 475, AMER. MACHINIST.**

**Wanted—Cost and production clerk, $75 to $100; state experience; for established foundry and machine shop. Box 483, AM. MACH.**

**Wanted—First-class operators on Gridley automatic and Potter & Johnston semi-automatic machines. F. I. A. T., Poughkeepsie, N. Y.**

**First class head draftsman and designer in a steam pump works wanted; must have good references as to character and ability; state age, previous experience and salary expected. Answer by letter only. Box 485, AM. MACH.**

**Wanted—Toolmakers on model and experimental special automatic machine work; good pay and steady work to competent men; give age, experience and references. Apply: The S. S. White Dental Mfg. Co., Princes Bay, N. Y.**

**Wanted—An A-1 machine patternmaker, one preferred who can work in machine shop when pattern work is slack, as it will be at first part of the time; new firm, good opening. Address Benj. D. Chamberlain, 187 Walnut St., Corning, N. Y.**

**Wanted—A first-class fixture and jig draftsman familiar with automobile motor, transmission and axle manufacturing; state previous experience, references, age and salary expected. Superior Motor Vehicle Co., 1449 Niagara St., Buffalo, N. Y.**

**Wanted—General foreman for shop employing about 40 men; a good opening for man of executive ability, who can handle men on fine work, systematize, and get the production; give experience, age and salary expected. Box 482, AMERICAN MACHINIST.**

**Wanted—A machinist and first-class handy all-around man for repair work in a cereal mill to do repair work of all kinds and some work in machine shop; wages $3 per day, time and a half for overtime and Sunday work; steady work the year around. Box 411, AM. M.**

**Wanted—A-1 planer hand experienced in working small intricate machine parts on a 26-inch Gray planer without jigs or fixtures; steady work and good wages. Apply, giving experience and references, The S. S. White Dental Manufacturing Company, Princes Bay, Staten Island, N. Y.**

**Wanted—Thoroughly reliable man as general superintendent of machinery manufacturing company employing 300 to 400 men; good permanent position with established company for competent man; state particulars as to age, previous employment and salary received. Box 484, AMER. MACHINIST.**

**Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.**

OHIO

**Machinists wanted on tool room work. Box 466, AMERICAN MACHINIST.**

**Competent lathe and vise hands by the American Tool Works Co., Cincinnati, O.**

**Wanted—Draftsman, familiar with detail crane design; state wages desired. The Toledo-Massillon Bridge Co., Toledo, O.**

**A prominent manufacturing concern in northwestern Ohio wants to engage a machine shop foreman who is up to the minute, is experienced handling men and who can get results; applicants please give references. Box 465, AMERICAN MACHINIST.**

**Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.**

PENNSYLVANIA

**Wanted—Mechanical draftsman, experienced in high speed engine work; give full details in first letter; all communications confidential. Box 469, AMERICAN MACHINIST.**

**Wanted—Patternmaker, experienced, reliable man for medium size shop; permanent position with chance to eventually work into foremanship, for the right man. Box 470, AMERICAN MACHINIST.**

**Wanted—Mechanical draftsman able to design and make complete details of special boring and turning mills and other machinery. Write fully, giving experience and wages expected. Box 463, AMERICAN MACHINIST.**

**Draftsman Wanted—One experienced in mine pumps of all classes; location, eastern Pennsylvania; give account of experience, education, age, salary wanted and how soon can start; permanent position. Box 474, AMERICAN MACHINIST.**

**Wanted—Supervisor of factory production and cost estimator; must be thoroughly familiar with operation costs on light and medium heavy machinery and specialties; none but first class, experienced men need apply; give references. Apply Lycoming Foundry and Machine Co., Williamsport, Pa.**

**Wanted—We have positions to offer from time to time for the following lists of first-class mechanics: Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.**

**The Monotype Company maintains a school to train young men to meet the constant demand for operators of its type casting and composing machine; these operators do so well that it receives more applications for places than can be filled. In making selections these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves. Lanston Monotype Machine Co., Philadelphia, Pa.**

RHODE ISLAND

**Wanted—Experienced men on planers, with new plant near Providence, R. I. Box 462, AMERICAN MACHINIST.**

## Situations Wanted

*Classification indicates present address of advertiser, nothing else.*

CONNECTICUT

**Position as superintendent or factory manager; 20 years' experience, 12 years as executive; experienced in the production of high grade interchangeable work. Box 487, AM. M.**

DISTRICT OF COLUMBIA

**Expert grinder, surface and universal, wishes position on fine tool work. Box 486, AMERICAN MACHINIST.**

INDIANA

**First class mechanical superintendent with eight years' successful executive ability; best of references, desires change; will go anywhere. Address "W. A. M." AMER. MACH.**

**Mechanic, 36 years old, with 10 years' experience as foreman and superintendent, in sheet metal manufacturing; good systematizer, and uptodate in modern methods of manufacture, desires a change by the first of June; Chicago or immediate vicinity preferred. Box 434, AMERICAN MACHINIST.**

MASSACHUSETTS

**Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 439, AMER. MACH.**

NEW JERSEY

**Toolmaker desires to make a change, South or West preferred; toolroom foreman at present, but position no object. "Toolmaker," AMERICAN MACHINIST.**

NEW YORK

**Mechanical engineer, college graduate, one year shop, 5½ years' drafting experience, designer, wants a change. Box 473, AM. MA.**

**Position as superintendent or foreman by experienced man in light machine manufacturing tool and special machine designing. Box 468, AMERICAN MACHINIST.**

**Mechanical engineer with broad experience, quick comprehension, thoroughly versed in designing and handling large machine shop and erection, desires position. Box 457, AM. MA.**

**Designing draftsman whose specialty is designing automatic machinery for making fine duplicate parts; good experience and excellent references. Box 476, AMER. MACHINIST.**

**Draftsman with valuable experience designing and superintending building of small automatic bench machinery, wants position where services will be appreciated. Box 477, AMERICAN MACHINIST.**

**Experienced foreman, middle aged, latest ideas, now employed, engineering work, dynamos and general machinery; A-1 hustler; can handle large force with ability. Box 427, AMERICAN MACHINIST.**

**Mechanic, age 30, thorough technical education, with large experience in Europe and United States as designer, instrument and toolmaker, desires change; first-class references from world's known concerns. Box 456, AMERICAN MACHINIST.**

**Mechanical engineer with broad experience, also knows how to adapt the machinery to the local requirements and various industries, desires position as traveling engineer or represent a firm at the coming Berlin Exhibition. Box 454, AMERICAN MACHINIST.**

OREGON

**Master mechanic with 20 years' experience, United States, Canada and South America; practical man; strong as constructing engineer and organizer of complete plans; services with such concerns as Mergenthaler Linotype Co., Campbell Printing Press Co., United States Metals Refining Co.; 40 years old, single; speaks English, German and some Spanish; wishes engagement where a high-grade service is required. Address Box 514, St. Johns, Oregon.**

PENNSYLVANIA

**Draftsman, mechanical, 10 years' experience, shop fixtures, open hearths, cranes and general designing, prefers position in West; salary $115 per month. Box 464, AM. MA.**

WISCONSIN

**Superintendent or assistant desires change; resourceful mechanic and executive; now employed as superintendent; age 33, married; experienced on high-grade work, tools, jigs and dies; designer of light special tools. Box 480, AMERICAN MACHINIST.**

## FOR SALE

**For Sale—Working interest in modern machine shop. Address "W." Box 467, AM. MA.**

**For Sale—One No. 10 Baush 16-spindle drill press, for ½" drills, in first-class condition. Box 437, AMERICAN MACHINIST.**

**For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; no foundry within 10 miles. Geo. H. Church, Bergen, N. Y.**

**For Sale—A complete Davis-Bournonville oxy-acetylene apparatus in first-class order; has been used about one year; can be seen at the Hartford Suspension Co., 150 Bay St., Jersey City, N. J.**

**Screw machines, three Hartford single spindle, can be seen running, one inch, one and one-half and two inch capacity, for sale or exchange for National-Acme multiple spindle. Warren Screw Co., Detroit, Mich.**

**For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.**

# Methods and Devices Used in Making Dental Vulcanizers

*A Variety of Tools for Accomplishing Accurate Operations*

By F. A. Stanley

Readers of the AMERICAN MACHINIST who are acquainted with the pleasures that are experienced only in dental parlors, and especially those of us who have arrived at that stage of development where factory teeth have become an essential part of our personal equipment, are familiar, in a general way, at least, with the vulcanizing process, the "heat treatment," involved in the preparation by the dentist of the rubber plates, which, by means of his molds and flasks, he manipulates to suit the mouths of his patients. But it is not the purpose of this article to recall painful memories of the past, nor anticipate troubles of the future; these preliminary remarks being merely by way of leading up to a description of a number of interesting methods and devices utilized by the Buffalo Dental Manufacturing Company, Buffalo, N. Y., in the production of its line of vulcanizers.

FIG. 1. VIEW IN CORNER OF TESTING DEPARTMENT BUFFALO DENTAL MANUFACTURING COMPANY

## THE VULCANIZER POT

The body of the vulcanizer proper is a copper vessel, 4 or 4½ inches in diameter, and of various lengths to suit the number of flasks to be vulcanized simultaneously. This copper receptacle is provided with a readily removable cap dropforged in steel, and secured by a device to be referred to later, while a flange around the open end of the utensil serves as a seat for a clamping and suspending medium for holding the pot in a sheet-metal heater which is equipped with gas or kerosene burner for boiling the water used in the pot for heating the work to the temperature required in the vulcanizing process. A number of vulcanizers with their heating apparatus are shown on the shelves in Fig. 1, which is a view in the testing department, and two of the vulcanizer pots with covers clamped in place are seen in the foreground, while a number of "cross-bars" (or clamping handles) and other parts are shown on the trucks to the left.

The copper shell, or pot, is drawn up as in Fig. 2 with ⅛-inch walls and bottom, and the first operation upon the shell is to braze on the ring at the open end, which constitutes the supporting flange or rim. This is a copper ring, bored out to fit the shell and brazed in place prior to the machining of the outside and face of the ring.

## FINISHING THE END OF THE POT

For the turning of the outside diameter of the flange, the squaring of the face and the machining of the back face of the ring, the copper vessel is placed in the lathe shown in Fig. 3, where the closed end is held in a three-jaw chuck, while the open end is supported by a bar held in the turret and having a revolving pilot tapered externally to expand three loose jaws slipped into the shell, as indicated in the illustration. These jaws are of considerable length and although they are independent of one another, they are prevented from sliding endwise to different positions in the work when the supporting pilot is pushed into place, by means of a backing ring, or collar, dropped into the shell before the jaws are put in place.

The cutting tools are all carried in one block on the rear of the cross slide, as shown, and are placed bottom side up, so that the spindle is driven forward throughout the series of operations. The hooked tool squares down the end of the ring, finishes the mouth, and, when run back, is fed crosswise to turn the outside of the rim to the required diameter. A second tool in the block is then fed forward to face the back of the ring. The carriage and cross slide are fitted with a system of stops to enable the work to be quickly and accurately machined. The snap gages for the diameter and thickness of the ring are shown lying upon the cross slide. When the operator runs the turret slide back, the taper pilot is withdrawn from the three supporting jaws and the work can then be removed from the chuck.

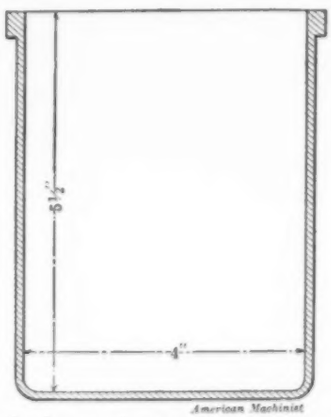



FIG. 2. LEWIS 4-INCH VULCANIZER POT

## SPECIAL TOOL BLOCKS FOR CROSS SLIDE

The tool block on the cross slide in Fig. 3 has become a standardized affair in this factory. Instead of fitting various combinations of cutting tools in an adjustable holder, serving for all kinds of

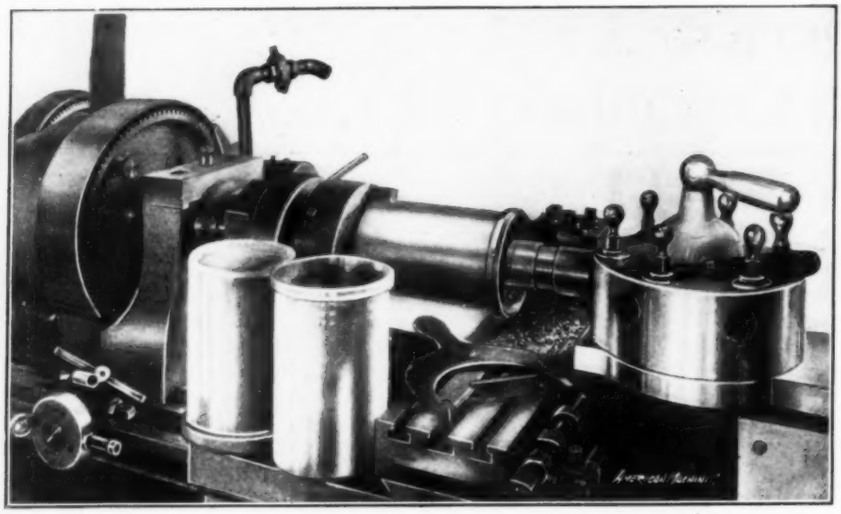


FIG. 3. MACHINING THE FLANGE OF A VULCANIZER POT

work, a separate tool block is made for each job and the cutters are a permanent feature in the block. That is, each block is fitted up with a special outfit of tools, two, three or more according to the requirements, and the block with its tools becomes a special fixture which is kept in a vault, when not in use on the machine. When required for use, it is checked out as a unit and the operator is not required to make any tool adjustments in setting up the job, aside from such as become necessary upon the sharpening of the cutting edges.

While the tools in Fig. 4 are not used upon the vulcanizer work forming the basis of this article, they are included here to illustrate clearly the principle followed in connection with this type of block and cutters. Of the three examples illustrated, special reference need be made only to block *A*, which has some very unusual features. This particular tool machines the brass piece shown at the front. In the top of the block are secured two facing tools and two inverted forming tools, one of which operates upon the outside of the piece, while the other machines the interior, when the cross slide is drawn forward after the first tool has completed its work. The periphery of the blank is nurled and this operation is accomplished by operating handle *B* which pushes the nurl carrier *C* outward from its seat in the body of the block and presents it to the edge of the brass piece. The nurling operation throws up a bur on the edge of the disk and to remove this the forming tool *D* is swung up by handle *E*, completing the series of operations with this tool equipment.

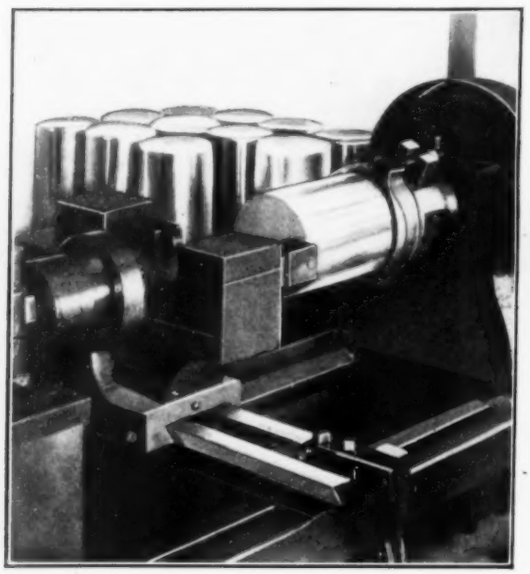


FIG. 5. HARDENING COPPER SHELL BY ROLLING IN LATHE

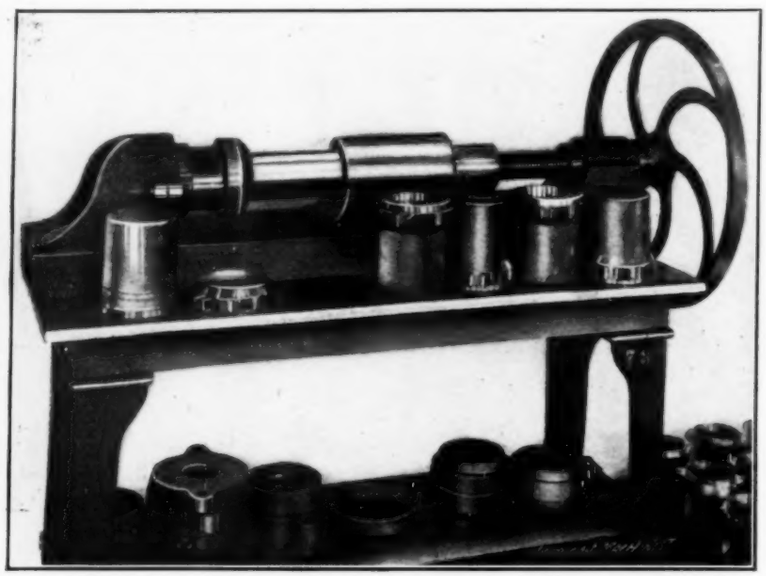


FIG. 6. PRESSING THE COPPER SHELL INTO ITS MALLEABLE IRON RING

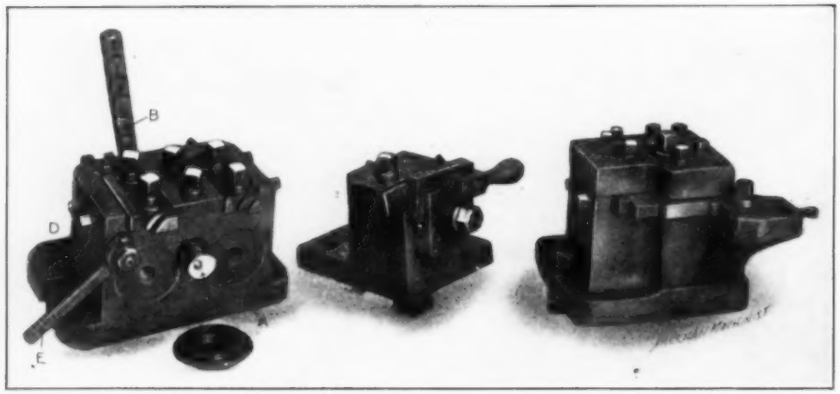



FIG. 4. SPECIAL CROSS-SLIDE TOOL BLOCKS

### A ROLLING OPERATION

In the process of brazing the copper ring to the copper shell of the vulcanizer pot, the latter is softened and it is necessary to harden it sufficiently to enable it to stand the steam pressure to which it will be subjected when in actual use. This hardening is accomplished by applying rolls to the outside diameter, to the bottom and the rounded corner, as illustrated in Fig. 5. Here a lathe is used, upon the cross slide of which are placed

blocks carrying hardened-steel rolls. In the illustration the tools are set up for working upon the bottom and corner. The roll for the end is cylindrical, while the roll which operates upon the corner is filleted to conform to the shape of the round corner and is carried upon a block at the front of the cross slide. The operation of rolling the cylindrical portion of the shell is accomplished with a plain roller, fed back and forth two or three times, suitable pressure being applied by a weight attached to the rear of the cross slide. The reduction in diameter during this process is about 0.010 inch. It has been found in this work that rolling down by the amount stated adds sufficiently to the strength of the vessel to enable it to withstand the pressure under which it is used.

During the rolling operation upon the outside of the shell the outer end of the work is supported by a cup with ball thrust bearing, revolving on a shank

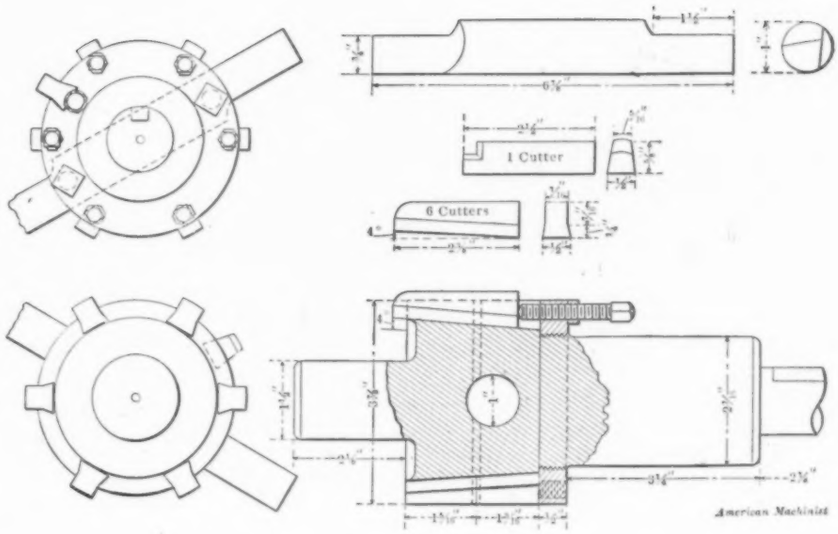



FIG. 8. EXPANDING BORING AND FACING HEAD

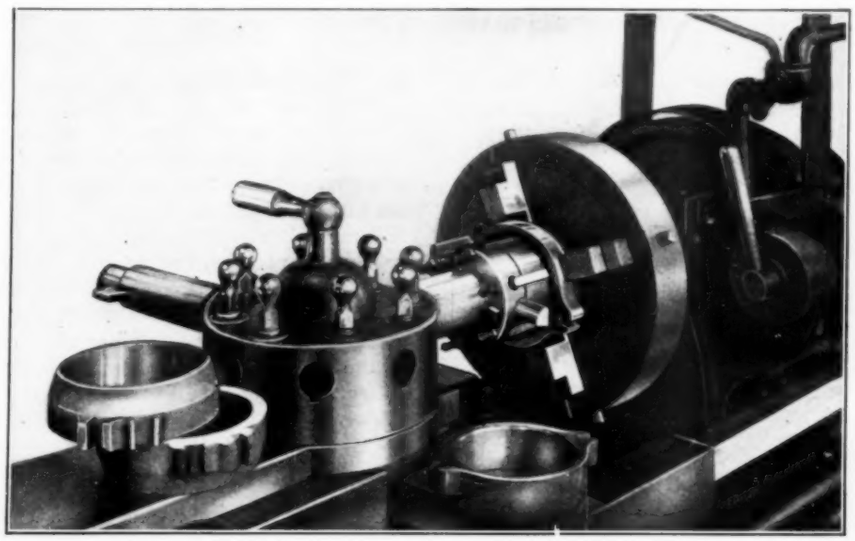


FIG. 7. MACHINING MALLEABLE IRON RINGS

its flange is seated against the ring by means of the spindle operated by the screw at the right. The spindle is provided with a cup at the front fitting the end of the work and the screw is fitted with a ball-thrust bearing. A number of pots with the rings in position, are shown upon the machine and on the floor near by. The form of the ring and its lugs is clearly represented in the engraving.

### MACHINING MALLEABLE IRON RINGS

The turret lathe, Fig. 7, is illustrated in operation on the rings just referred to. The machining operation consists in boring the interior, facing the end and rounding the corner of the metal around the bore. The cutter head supported by the turret is shown in detail in Fig. 8. It carries a series of inserted tools which give the hole the required diameter and round the corner. As will be noticed, the cutting tools are readily expanded to fitted in the tailstock spindle. The method of mounting the work on the head-spindle fixture for the rolling operation is clearly indicated in the halftone.

### FORCING ON RINGS

Each vulcanizer pot is provided with a malleable-iron ring, which is forced in place against the copper flange and which has a series of lugs adapted to receive the cross-bar and bolt by which the steel cap is securely clamped in place to close the receptacle tightly when the vulcanizer is in use. These malleable-iron rings are machined, polished and nickel-plated prior to being forced onto the shells. The latter operation is performed in the press represented in Fig. 6. This operation needs little in the way of explanation. The ring is held against the support at the left-hand end of the press and the copper shell is forced back until

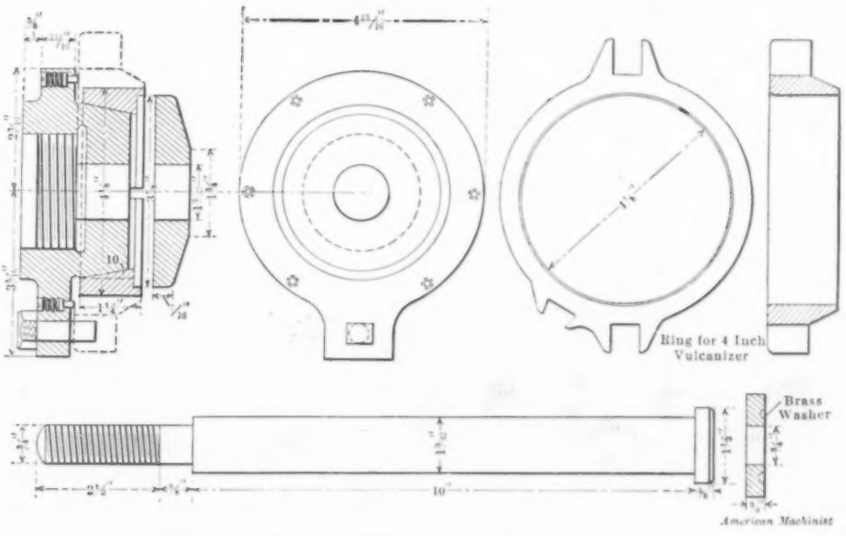



FIG. 9. MILLING FIXTURE FOR VULCANIZER RING

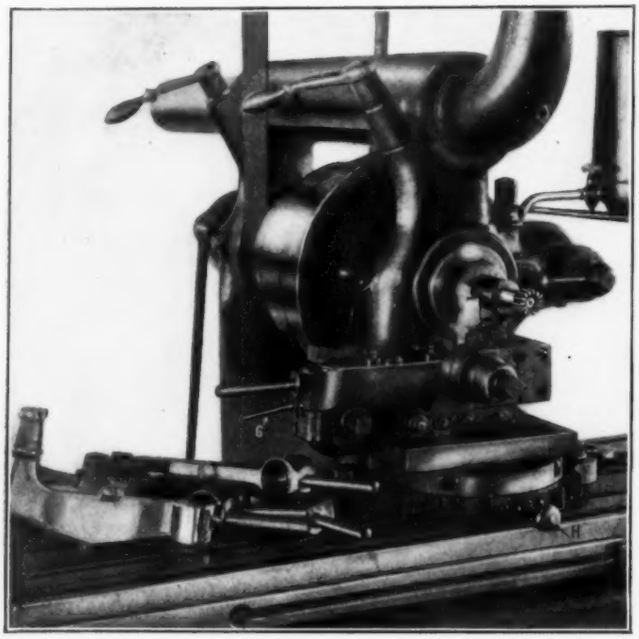


FIG. 10 MILLING VULCANIZER CROSS BARS

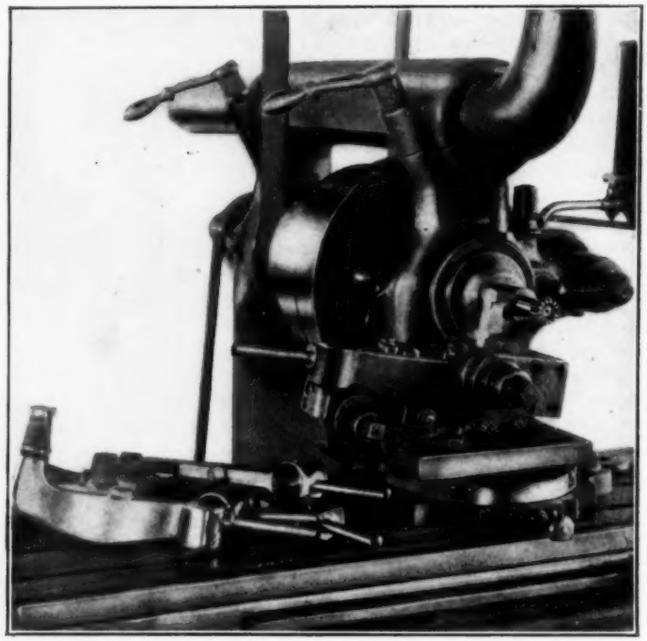


FIG. 11

maintain the required diameter. A round cutter fitted in a hole drilled crosswise of the head, faces the end of the casting, both ends of the cutter operating upon the surface of the work.

The outside of the ring is profiled with the work held in a milling fixture, Fig. 9. The drawing shows the proportions of the ring, the method of mounting the milling fixture on the rotary head, and the clamping ring and plate by which the work is gripped internally when placed on the fixture. The work abuts against a series of spring stops and is driven positively by a stud engaging in a notch at one side of the ring.

MILLING VULCANIZER CROSS BARS

A series of interesting milling operations are illustrated in Figs. 10 to 13.

FIG. 14. LEWIS 4-INCH VULCANIZER CROSS BAR

Figs. 10, 11 and 12 show the method of machining the opening between the lugs at the bent end of the vulcanizer cross bar, Fig. 14. The opening formed between these lugs which enables the cross bar to be slipped into the retaining notch in the malleable-iron ring around the vulcanizer pot, as in Fig. 15, tapers slightly, the inner surfaces of the upper lugs *F F'* being milled at an angle as shown in the drawing, Fig. 14. The fixture represented in place upon the miller table in Figs. 10 to 12, is adapted to swivel upon its base through an angle of 180 degrees, to permit the notch to be milled in each side of the work, and

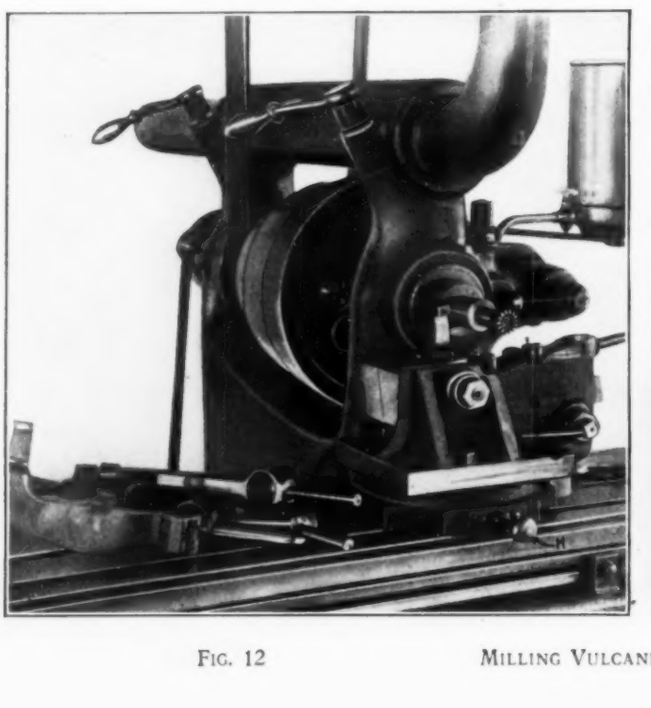


FIG. 12 MILLING VULCANIZER CROSS BARS

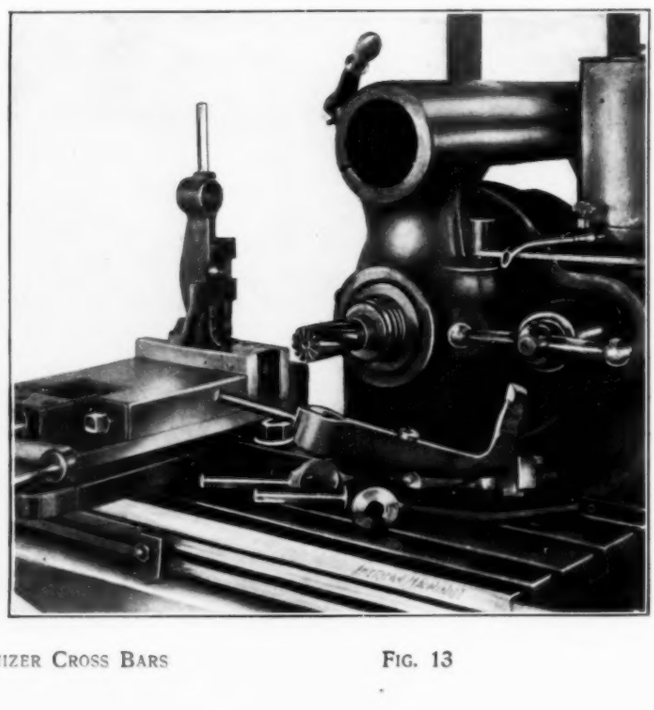


FIG. 13

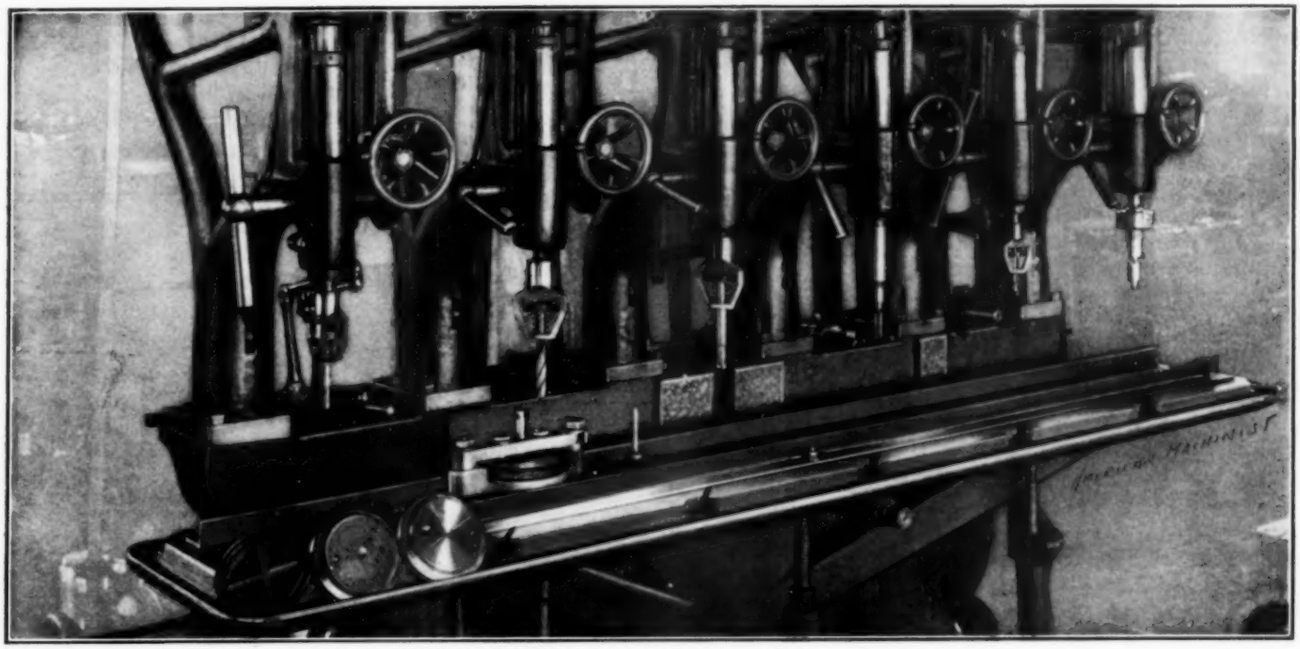


FIG. 16. METHOD OF HANDLING JIG WORK UNDER DRILL SPINDLES

the upper portion of the fixture to which the work is secured, is adjustable vertically about a pivot at one end to provide for the milling of the sloping face of the lugs *F F'*. Thus, in Fig. 10, the fixture is shown set for taking a straight cut between the lugs, with the shank mill in the spindle. Fig. 11 shows a second setting accomplished by turning handle *G*, which operates a cam, to lift the outer end of the holder and swing the work up sufficiently for the milling of the sloping surface *F*, Fig. 14. Another position is illustrated in Fig. 12, where the body of the fixture is shown indexed half way round and swung up for the milling of the sloping lug on the other side of the cross bar. The locking pin, by which the fixture is secured in either of the positions represented in Figs. 10 and 12, is shown at *H*. After the cut has been taken, with the fixture set as shown in Fig. 12, handle *G* is again operated to swing the work down for the milling of the straight surface on the lower lug on that side of the piece. In this way, the gap between the lugs upon opposite sides of the bar is machined to uniform width and taper.

Fig. 13 shows the method of milling the round corner or fillet *I*, Fig. 14. As illustrated, the cross bar is held vertically in a vise, while the milling cutter is run straight into the corner. The method by which the work is set upright in the miller vise and properly located for the taking of the cut, is clearly shown in the halftone.

### A HANDY DRILLING AND TAPPING ARRANGEMENT

The six-spindle drill in Fig. 16 is arranged specially for operations upon the drop-forged cap for the vulcanizer. Several of these caps will be noticed lying upon the drill-press table. Two holes are drilled and tapped in the cap to receive a mercury bath to which the thermometer is attached, and for the manifold which carries a safety valve blow-off and gas regulator. Under the six spindles, the first operation is to drill the small hole, the second to drill the large hole; under the third spindle the end of the large

FIG. 15. METHOD OF CLAMPING VULCANIZER COVER

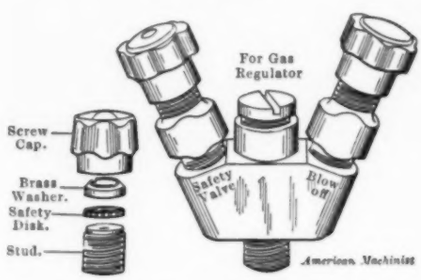



FIG. 17. VULCANIZER MANIFOLD AND SAFETY DISK

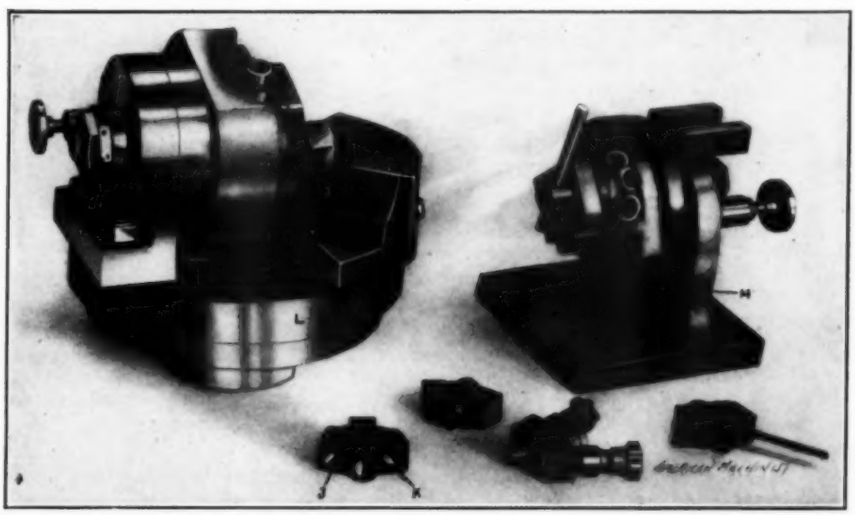


FIG. 18. INDEXING FIXTURES FOR DRILLING AND BORING ANGULAR HOLES

hole is chamfered, while the fourth spindle carries a tap for this hole. A tool in the fifth spindle removes the bur from the inside of the hole and the sixth spindle is used first for reaming the small hole, then a tap is slipped in place and the hole is tapped.

The method of guiding the work from one spindle to another is plainly shown in the illustration. The guide bars are clamped the entire length of the table, parallel with the spindle centers and the right distance apart to form a channel along which the work-holding fixture is slid from one position to the next for successive operations. This method of transferring work quickly from one spindle to another is employed in numerous instances in this shop, the holding fixtures being uniform in size and adapted to slide readily between the guide strips shown on the table.

### An Indexing Fixture for the Turret Lathe and a Drill Jig

The manifold referred to, which is attached to the vulcanizer cap for the reception of the safety valve and blow-off is shown in the sketch, Fig. 17. The body of this piece is of brass, cut from a bar, which is made to the required section at the mills by the extrusion process. The blank as sawed from the bar has to be drilled and tapped at an angle from opposite corners, and from the bottoms of the two holes thus formed, two smaller holes are drilled at a still greater angle to enter the passage in the threaded hub which screws into the cap of the vulcanizer.

The manifold is shown before and after completion, in the foreground of Fig. 18. The holes at *J* and *K*, Fig. 18, are put in at the proper angle and tapped with the work held in the screw-machine fixture shown at *L*. This is an indexing attachment, by means of which the manifold is presented to the tools at the required angles for the drilling and tapping operations. The location of the index pin, the clamping jaws, the method of counterbalancing, are all clearly shown.

The drilling jig for the small connecting holes, between the tapped openings and the common passage in the threaded stem, is shown at *M*, Fig. 18. The construction of this jig is also obvious and no description is required.

### A Hand Operated Punch Press

The safety disk shown in Fig. 17, is a device applied to the vulcanizers to prevent accidents in case the steam pressure is allowed through carelessness to rise to a dangerous point. In this event, the safety disk is blown out and the pressure relieved. The disk is made of sheet copper about 0.0009 inch thick. It is blanked and drawn to the cup shape shown in the hand machine illustrated in Fig. 19. The sheet metal is rolled very accurately and every sheet before it is cut into strips of the proper width to run through the press is thoroughly inspected for uniformity of thickness and tested for strength. The metal is so light that it is cut to the required width by a paper-trimming knife mounted at the end of the board upon which the press is placed. A combination punch and die is used, which at one stroke cuts the blank and forms the shallow cup. The diameter of the disk, when cupped, is about 3/8 of an inch and the depth of the rim less than 1/16 inch.

The stock feed consists of a small roller *N*, Fig. 19, beneath which a device something like the presser foot of a sewing machine is reciprocated by rocker shaft *O*, actuated from the driving shaft at the top of the machine.

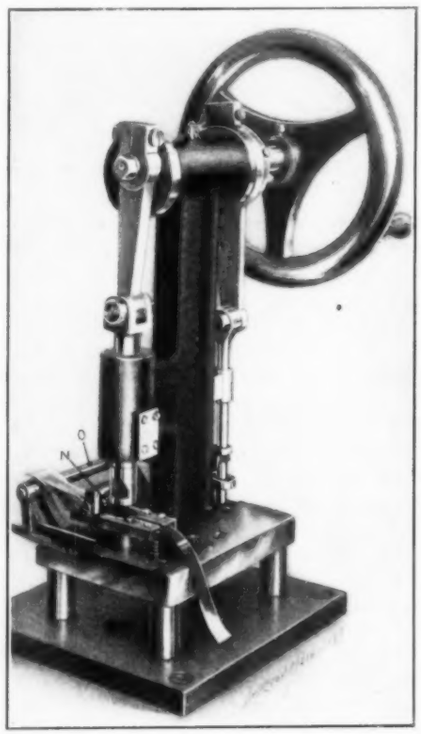


Fig. 19. Blanking and Drawing Press

The base of the press proper is about 12 inches square and the whole outfit is mounted on a wood base so that when it is to be used it is easily removed from its shelf in the tool vault and placed on the work bench.

### The Testing Apparatus

Reference has already been made to the halftone, Fig. 1, which presents a view in one corner of the testing department, showing a number of vulcanizers in position for testing, also numerous parts of the vulcanizers on the trucks to the left. The vulcanizers are tested to about 500 pounds water pressure in another department. In the department illustrated, they are put under steam pressure up to 106 pounds per square inch, the thermometers reading 320 degrees Fahrenheit. This is the pressure at which the apparatus is actually used and as stated above, in case it is exceeded through carelessness upon the part of the user of the vulcanizer, who omits to watch his thermometer, the safety disk will blow out and relieve the pressure.

## Seasoning Castings

By E. A. Dixie

In the Landis Tool Company's shop in Waynesboro, Penn., the machine beds, tables, etc., are rough planed and then set aside to season for from 3 to 6 months, an annoying thing to be compelled to do, with orders piling up in the books, but then it's the penalty one pays for having a conscience, and a reputation to keep up. After going through their shop I went to another shop in a remote part of the country where they build machinery for another purpose. When I told the proprietor about the seasoning of the castings he said "We season our castings in a day or so, by heating them to a dull red heat and allowing them to cool slowly."

I have been up against this quick seasoning proposition before and there is a way in which it can be accomplished but *not by heating*.

A man came into the shop once and wanted some jigs made for drilling flanges. The holes were six in number on a 7-inch circle and the allowance was 0.002 inch. I told him the pieces would have to be turned all over and allowed to season for several months. He said the jigs were wanted at once and that he would undertake to season the castings in five or six hours. This he did by heating and cooling slowly. The jigs were made, tested for accuracy and passed. In three weeks a complaint came in that the jigs were turning out bad work. When the bushings were forced out and the jig measured up it was found that the distance center to center of one pair of opposite holes had changed 0.007 inch.

Another way of doing quick seasoning was told me by a man who has a reputation for doing very accurate work and while I have never tried it, it looks good to me.

He had a number of small brackets to machine, these were bored, reamed and lapped and a spindle fitted. Usually plenty of time was allowed so that the castings could season after the boring operation, but on this occasion the job was in a hurry so the work was put through to completion only to find that the castings in a few hours became twisted and bound the spindles so that they would not turn. My friend had a brilliant inspiration, and put the remainder of the castings on the polisher's bench where they would be vibrated. After jigging up and down and backward and forward on the bench for a few days it was found that the castings had adjusted themselves.

# Form of Agent's Agreement That Has Proved Satisfactory

*Obviating Friction between Agents and Protecting Territories*

By Murray Shipley *

Some years ago our company was constantly drawn into disputes between its agents as to machines shipped by one agent into the territory of another. Various complications arose which frequently required our interference in these disputes, and to make a settlement of the matter such as was entirely agreeable to both agents, was almost impossible, and consequently our good standing with our agents was constantly imperiled. In addition to this, the mere fact that such complications were possible, detracted from the feeling on the part of the agents that they could put forth their utmost efforts on each and every deal without fear of the commission going elsewhere in event that the order was placed.

To avoid complications of any kind with our agents, we developed a uniform agreement, now in force with all of our agents. We have found that it eliminates all the former troubles and is satisfactory to both the manufacturer and the merchant.

### The Question of Territory

We are aware of the fact that some manufacturers feel no hesitancy in quoting to a consumer in an agent's territory when opportunity presents; but we have always been opposed to such a policy, and the wisdom of not doing so seems so apparent that it hardly calls for the explanation, namely—that no agent can reasonably be expected to put forth his utmost effort in behalf of the manufacturer if there is any possibility of his meeting the manufacturer in competition for any order. The manufacturer must be absolutely fair and equitable in his dealings with the merchant if he is to get from the merchant that last ounce of effort which many times is necessary to secure an order. On the other hand, the manufacturer has an entire right to exact of the merchant just as great loyalty on his side.

In one sense, the territory is the capital of both the manufacturer and the merchant, and if the manufacturer agrees unequivocally to make no effort to secure business in a given territory excepting through the merchant, the merchant on his side should, of course, agree to certain things, for instance, that he will not sell machines competing with those made by the said manufacturer, with the further understanding that the said manufacturer is able to reasonably well supply the merchant with such machines.

The fact that the merchant occasionally loses an order because the manufacturer cannot deliver promptly, scarcely offsets the fact that the manufacturer loses many orders by confining himself to the one dealer alone, instead of selling through other dealers.

The merchant must also be willing to restrict his quotations on said machines to the territory which has been allotted to him, and not interfere in prospective sales of such machines by other agents. (Incidentally, we think this territory should be named exactly, that is, either by State lines, by rivers, by counties, or some way, which will prevent any uncertainty as to the territory covered by the agent.) Of course, it goes without saying that the merchant should push the interests of the manufacturer to his utmost ability.

Our courts have held that on patented articles, the manufacturer has a right to demand that the prices established by him shall be maintained, and a reasonable price having been established, the manufacturer should insist upon the merchant selling at this price, unless the conditions are entirely unusual, such as in a locality where the cost of doing business is excessive as compared with localities in general, or where the credit risk is such that a reasonable extra price (say 1 per cent.) ought to be maintained.

### Changing Prices

Opinion seems to differ as to the correct method of changing prices. Our feeling is that the merchants should be given ten (10) days time in which to notify their customers of an advance in price, and that the manufacturer should enter at the price in force previous to the advance, *bona fide* orders taken by his merchants during this ten days.

The question of accepting stock orders by the manufacturer is a debatable one. Unfortunately, some merchants do not recognize their responsibility in placing such orders, and upon the approach of a period of depression, will cancel all or so much of such orders as suits their pleasure; and the manufacturer, who of necessity has provided the raw material, and probably paid for much of the labor and overhead expense involved in manufacturing such product, is helpless, for it means either accepting the cancelation, or possibly loading the merchant to such a point as to endanger his credit, or bringing about an open rupture between the two parties, or both.

### Orders for Stock and Shipments

Our practice regarding stock orders formerly, was to have in our agreement a definite understanding as to how many machines of each size any merchant might order out of a "lot," when his orders exceeded that number they were put forward into the next lot. This was done in order that no one merchant, or any few merchants might monopolize the output of the shop, and thus discourage other merchants. This practice, however, we have changed, and now accept no orders at all unless the machines represented by these orders have been sold to *bona fide* customers and the orders are accompanied by definite shipping instructions, with the name of the customer; and at the same time we reserve to ourselves the privilege expressed in these words, "any evasion of the intent of this clause shall justify cancelation by the manufacturer of any order affected by such evasion." This places our entire future product which is unsold (that is, unsold to consumers) at the disposition of every merchant representing us, and does not induce him as heretofore, to possibly "plunge" on our product and order for stock more than he is justified in ordering.

Of course the manufacturer should agree to be responsible to the merchants for any penalty for nondelivery which the merchant suffers, when such penalty is made known to the manufacturer at the time he is called upon to name a date for delivery.

The manufacturer should assume the responsibility that his machine will fulfil all the conditions named in his printed matter, and for their quality. But it is manifestly unfair that he should be put to the expense of investigating claims for bad workmanship, inaccuracy, defective material, etc., which are proved groundless, or for demonstrating the capacity of a machine which has been manifestly ignorantly operated.

The manufacturer should supply such printed matter as applies to his line, without charge to merchants.

The terms of payment should be agreed upon definitely. A reasonable position to take is that invoices shall be dated *the day machines are ready for shipment*, for the reason that if that particular merchant did not take them, any one of the

*Treasurer, The Lodge & Shipley Machine Tool Company.

other merchants would be glad to have them; and therefore the manufacturer could get his money out of them at once. The same argument applies to a machine held for lack of instructions, by instructions, or awaiting the arrival of some attachment made by another manufacturer.

Desiring to make such a form of contract as would appear upon sight equitable alike to the merchant and to the manufacturer, this matter was brought to the attention of the National Machine Tool Builders' Association, and a committee appointed by it met a committee appointed by the merchants. A number of conferences were held, much correspondence was had, and out of this a contract was evolved.

We have had few, if any, objections by merchants to this form of contract, and in many cases it has been commented upon favorably. It is not perfect by any means, and doubtless will be changed from time to time. One change which is strongly indicated at the present time, is upon the question of the way the merchant takes his orders. If one undertakes to buy an automobile today, he deposits a considerable portion of the purchase price in cash, and the balance he pays before he obtains possession of the automobile, in the meantime signing a printed contract for the purchase of the machine.

### Standard Order Form Desirable

It seems to the writer that the merchants and the manufacturers should devise a standard printed form, upon which form all orders for machine tools shall be taken, and duly signed by a responsible person for the purchaser; and in this order it should be stated that the order is a *bona fide* one, and not subject to cancelation under any conditions. This would have two desirable effects—first, it would prevent the over-optimistic salesman from taking an order from his friend with the understanding "subject to cancelation when ready for delivery," or any equivalent phrase. It would also deny the purchaser who is lax in his sense of honor, freedom to cancel his order.

Of course, it is difficult if not impossible to draw a contract or agreement which will cover all phases of the selling of machine tools, and while it is well to have its salient features agreed upon, after all a spirit of absolute equity and fairness on the part of both merchant and manufacturer must be present always, if the best selling results are to be obtained; and confidence, one in the other, must at all times be supreme.

# Comments on Motor and Belt Drive

*By John R. Godfrey*

Judging from the discussion regarding electric-motor drives at the American Society Mechanical Engineers' meeting, the question is no nearer final solution than it was several years ago. To be sure, motors are infinitely better in many ways, they stand abuse of various kinds in a really remarkable manner and can be relied on to a much greater extent than ever before. But the question of when to use individual-motor drive or how large a group to drive from one motor, is still far from practical solution.

No one will deny that a shop without shafting or belts is more pleasing to the eye than the old way, but so would hanging gardens and frescoed walls add to the attractiveness of the place—and might even aid in production by their subtle stimulating effect on the worker. But the question in each case is, what is the net cost when all things are considered?

### A Railroad Illustration

I am tempted to digress a bit and recall a test of locomotive valve gears on a well known railroad. Every steam-engine expert throws a fit when he takes a card from a locomotive cylinder and would be willing to swear the engine could not get over the road if he hadn't been on it. The "cards" are far from the standard he is looking for and he immediately writes a paper on the wastefulness of the locomotive, and has it in the scrap heap inside of 30 days. But they've been doing this for 30 years, so the locomotive is used to it.

So this railroad designed and built a valve gear that was O. K. by the books. It would give as pretty a Corliss card as any engine you ever saw. Sharp cut-off, low compression and all the rest, while the "card" from the old link motion was a joke, because it resembled a sweet potato more than anything else I can think of.

But after a good long trial on the same trains day after day, the old link engine burned less coal and had less repairs than the perfect valve gear, and the link, or its practical equivalent, is still doing business at the old stand.

### Those Miles of Shafting

Now it is just possible that the miles of shafting and belts which our friend Riddel referred to as being out of date, may be cheaper than individual motors in some cases. I don't claim that this is so, yet I presume I could find certain cases where this old-fashioned method was saving money for the firm. The case of the Link Belt Company, mentioned by Mr. Hess, seems to be a case in point, even without the refinement of ball-bearing hangers.

### Groups That Were Too Small

There is another large plant I know of, where, after careful consideration, the tools were grouped and so driven from one motor. The manager was recently asked whether he had regretted the arrangement and he answered that he had —regretted that the groups were not larger. And these are comparatively large tools.

Motor drives are more powerful than the old narrow belt on the five-step cone, but lathes are built today for a six-inch belt and can be built to pull any cut that is necessary. This does not mean that it is always advisable to do so, but it is well to remember that it can be done.

I trust no one will run away with the idea that I am opposed to motor-driven tools, for such is not the case. There are many instances where it would be folly to drive in any other way. Large machines can probably be driven best in this way in nearly all cases, and there are cases where it pays to drive small machines with an individual motor, even at a higher cost for power and repairs. The other advantages may easily counteract these charges.

### Consider All Sides

What I wish to make clear is, that in this question, as in any other, we cannot afford to be led away by any one line or argument, but should consider them all. Conditions that prevail in one instance, and best served by a certain type of drive, is no indication that such a type is best in all cases.

It is a wise shop manager who can count all these costs and decide on the best drive for his particular case.

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It is interesting to note that among the list of nominations selected for final consideration for the third election to the Hall of Fame, New York University, there appear the following eminent names drawn from the engineering field: Alvan Clark, inventor; George Henry Corliss, engineer; James B. Eads, engineer; Charles Goodyear, inventor; Richard M. Hoe, inventor; Cyrus Hall McCormick, inventor; William Thomas Green Morton, inventor; James Rumsey, inventor; Alfred Vail, inventor; Horace Wells, inventor; John Ericsson, inventor; John A. Roebling, engineer. Election is held every five years. Forty new names are to be added at this election, to be selected from a list submitted of 206. Every name suggested, within reason, is sent on to the electors, provided it is seconded by a member of the University senate, and the person proposed has been dead at least ten years.

# Special Tools for Riveting Small Gears

*By Fordyce W. Brown*

The manufacture of small compound-gear wheels, that is, two flat gears of different sizes riveted together concentrically and working as one gear, also gears pivoted on a central arbor or staff require the use of special tools and gages, two of which are shown in the accompanying drawings. The compound

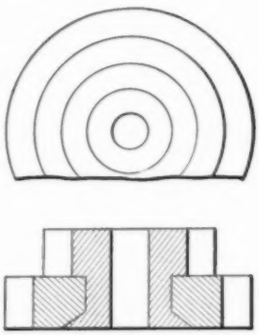

FIG. 1. RIVETED GEARS

gears mentioned vary in size from 0.20 to 0.35 inch, and are of brass, as shown in Fig. 1.

Obviously, the teeth must be cut in each member separately and the two parts then riveted, or "staked," as it is technically called, together.

The machine used in this operation is shown in Figs. 2, 3 and 4. Fig. 2 is a plan view, Fig. 3 a side elevation, and Fig. 4 a rear elevation. The machine is, in fact, a miniature power hammer and consists of the base plate *A*, supporting the upright *B*, the pedestal *C* and *C'* and the stake *D*. The upright *B* is bored out for the line shaft *E* supported by the bushings *e e*. This shaft has an en-

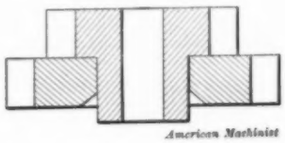

FIG. 5. GEARS READY FOR RIVETING

larged end *E'*, which has a 30-degree slide cut in it to accommodate the block *F*. The upper end of *A* carries the piece *G*, supported by the shaft *H*. One end of *G* is slotted to accommodate the hammer arm *I*, which is capable of adjustment by means of the knuckle joint, as shown. The other end is elongated to provide for the link *J*, which connects *G* and *F* and supplies the tilting motion of the hammer head. The anvil, staking spindle, etc., are clearly shown at *D*, the spring being used to keep staking spindle clear of the work when hammer is not running. Shaft *E* is rotated by a belt running over the pulley *K*. This pulley also forms one member of a friction clutch, the other half *L* being fastened to the shaft by a set screw. *K* is controlled by lever *M* supported on pedestal *C*. A ball bearing is provided as shown in order to take up thrust from friction clutch. The block *F* is adjustable within small limits in the enlarged part *E'* to allow for different strokes, although it was afterward found that in practice this was not altogether necessary. After the stroke was once learned and the block set at that particular point it was rarely ever necessary to change it. The operation of staking was performed by placing the two pieces together upon the anvil as shown in Fig. 5. By pressing

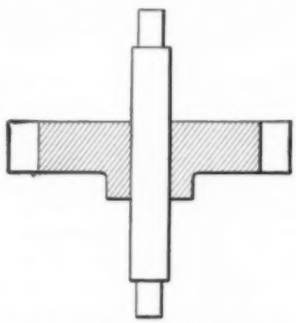

FIG. 6. GEAR ON SPINDLE

on lever *M* the friction clutch is brought into action, *K* being always in motion, causing the shaft *E* to rotate, this in turn producing the vibratory motion of the hammer, one stroke for each revolution of the shaft. Enough stock was left on the central portion of the smaller gear that the hammer could drive it down into the countersink in the larger gear, thus riveting both together solidly. The machine was speeded up to about 600 revolutions per minute, as this was found to give the best results. It should be further stated in explanation that the center hole through wheels was not drilled to size previous to staking, as that operation forced the stock in, partially closing the hole, which was afterward opened to proper size.

The other class of work mentioned consisted of wheels mounted on central arbors as per Fig. 6. These wheels were frictioned on the arbors, and it was often necessary to change their position by one or two hundredths of an inch. This was at one time done more or less by guess, until such methods were superseded by the use of the tool shown in Fig. 7. This tool consisted of a cast-iron stand similar to the staking stand *D* shown in Fig. 3. The lower part was bored out for the anvil *a*, while the upper end was threaded as shown and carried the barrel *b*. The plunger *c* worked in connection with barrel *b*, so that by turning *b* the plunger *c* could be raised or lowered, being prevented from turning by the set screw *d*. Both the barrel and the upper part of stake were graduated in a similar manner to the micrometer, the graduations being numbered, however, only on the barrel. The *modus operandi* was as follows: The wheel and staff were placed upon the anvil, which was drilled to accommodate staff, as was also the

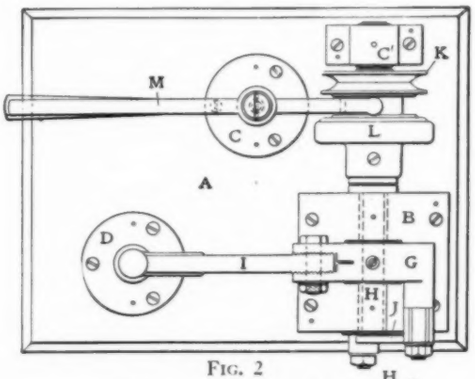


FIG. 2

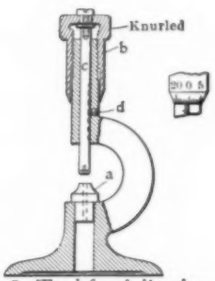


FIG. 7. Tool for Adjusting Gear on Spindle.

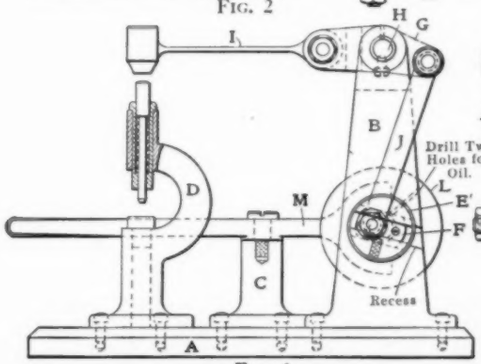


FIG. 3

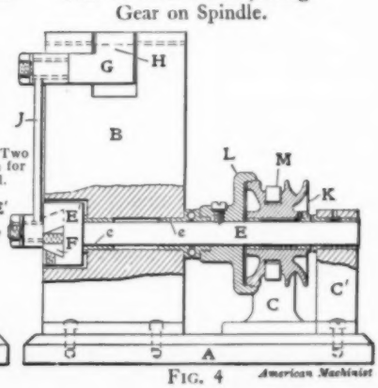


FIG. 4

plunger *c*, except that it was drilled smaller so as to receive only the pivot of staff, while the plunger rested on the shoulder of staff. This was done in order to avoid breaking off pivots, which might not be strong enough to stand strain necessary to move the wheel. The wheel and staff being in position on the anvil, the barrel *b* was then lowered until the end of *c* rested against upper shoulder of staff and the reading taken. Knowing, then, the distance it was desired to move the wheel, it was an easy matter to rotate the barrel still further until the required number of divisions on *b* has passed the center line, one mark for every thousandth. In this way the change in position could be made quickly and accurately to the thousandth part of an inch. One tool sufficed either for raising or lowering; if it was desired to raise the wheel, the lower staff went into the anvil and the plunger pressed against the upper shoulder of staff, driving down the staff or raising the wheel. In lowering wheel on staff the reverse was, of course, the case.

# Prevention of Scale in Hardening

*By Charles A. Haeusser*

The prevention of the formation of scale on steel tools during the process of hardening is not a difficult task when heated in a proper oven or hardening furnace. The only precautions that are necessary are to keep the oven or furnace clean, to keep the supply of air and gas regulated in such a manner that there is no flame visible in the heating chamber, and the exercise of a little care in preventing, as much as possible, exposure of the heated steel to the air when taking it out of the furnace to plunge it into the water.

In many shops, however, and in quite a number of large ones, they do not have properly constructed furnaces, and as a result the toolmaker who is obliged to use a blow pipe on an open coal fire finds it somewhat difficult to prevent the formation of scale and a consequent pitting of the tools he hardens.

In all cases the scaling of red-hot iron or steels is due to the oxygen of the air combining with the incandescent metal and oxidizing it. Thus the remedy is to prevent the free oxygen from coming in contact with the heated metal.

In the case of an open forge where charcoal is used for fuel, no scale is formed, because only a moderate blast is used and the air quickly unites with the carbon and is completely burned before it has a chance to reach the metal. Therefore, it is necessary to introduce between the blast and the steel a type of fuel which will easily absorb this free oxygen that is not taken up by the coal.

If an open fire is used and there is no charcoal available, it is a good idea to stick pieces of wood around the metal and replace them as soon as they are burnt out. In this way a great amount of free oxygen is absorbed. When a blast is used the metal should be completely covered with pieces of wood, allowing only a small opening for the blast to enter. The blast is then projected onto the wood, at the bottom of the hearth and at such an angle that it is deflected onto the metal, after first coming in contact with the wood. In this manner, the free air from the blast goes into combination with the wood and is burnt before it comes in contact with the metal. This method has been used in hardening drills, taps, etc. When these were drawn out of the furnace they were found to be perfectly clean and free from pits, nevertheless, it is difficult to obtain an equal temperature at all parts of the tool without removing the wood.

There are other methods of preventing scale when an open hearth is used, and that is to coat the metal with a substance that will resist the air of the blast. Ordinary soap will have this effect, but some hold that it prevents complete hardness from being obtained. Experience has shown, however, that if a steel will harden dead hard when thoroughly clean, it will also get dead hard when plunged at the correct temperature, if it has been coated with soap.

A small application of cyanide when the tool has reached a dull-red color will also prevent the formation of scale, but in many cases the method is objectionable for the reason that it is very difficult to judge the correct temperature for quenching, on account of the flare of the cyanide. It can readily be seen that in any method for preventing scale, the principal factor is to keep the air from coming in contact with the metal while it is red-hot.

### Several Methods in Use

There are many new methods of hardening where the possibility of scale is done away with entirely. One of these is the electric oil-heating bath, which consists of a rectangular cast-iron tank fitted with lugs cast vertically, in which fit the heating units. By distributing these units, an even temperature can be maintained throughout all parts of the oil. On one side of the tank is a protected recess, where a thermometer is placed to indicate the temperature of the bath. It is through the aid of the thermometer that the proper degree of hardness can be obtained, independent of the judgment or skill of the operator.

The maximum energy consumption of this oil bath is sufficient to heat the oil to a temperature of 450 degrees Fahrenheit, in less than an hour. The maximum temperature that it is possible to obtain is about 600 degrees Fahrenheit. In particular work the bath is cooled to a temperature of 250 degrees Fahrenheit, then after the work has been put into the oil the temperature is slowly raised to the proper degree. In this way the metal is not subjected to any shock and there is no possible danger of injury to the tools. By this method tools can be produced that have a uniform degree of hardness. In addition to this, one man can temper a great quantity of tools in a shorter time than when a blast furnace is used.

However, in shops that do their own high-speed tool hardening, and do not use the barium chloride, or a more recent method, they are always troubled with the formation of this scale on the surface of the tool. If it happens to be a tool that can readily be ground into shape after hardening, then this scale is not so troublesome, but in forming tools of complicated shapes, some other method must be resorted to.

Acids have also been tried, but after the scale had been removed, the acid attacked the tool in various places and rendered it useless. The way that this was finally overcome was to use the sand blast. The tools retain their original form, sharp edges are not injured, and they come out a beautiful gray color. The finish, of course, will vary accordingly to the fineness of the sand used.

## Heroult Furnace Licensees in America

There are three American licensees under the Heroult electric furnace patents in the United States. They are the Halcomb Steel Company, Syracuse, N. Y.; the Firth-Sterling Steel Company, McKeesport, Penn., and the United States Steel Corporation. The licenses to the last named interest permit the operation of a considerable number of electric furnaces at its various plants. Under their provisions, one 15-ton Heroult furnace is now in continuous operation at the South Chicago works of the Illinois Steel Company and another of the same capacity is nearing completion at the Worcester works of the American Steel and Wire Company, to run in conjunction with a basic open-hearth furnace. A number of additional furnaces are contemplated, but they will probably be larger than the 15-ton type.

# The Use of Stereographic Charts and Solid Models

## *Methods of Laying Out Charts; Making of Various Models*

By John B. Peddle *

Two dimensional charts for the representation of mathematical equations or experimental data are in very common use nowadays and are everywhere recognized as valuable devices for giving a clear conception of the manner in which the variables are related.

Their application is generally restricted, however, to cases where there is but one variable and its function if the variation to be shown is continuous. Nevertheless cases often arise in which there are two variables and a function to be represented and where it is desirable to show a continuous variation for all three.

A simple and logical extension of the two-dimensional chart, in which the variation is represented by a plane curve, leads us to the idea of a solid, three-dimensional chart in which the variation is shown by a surface.

It has received some attention at the hands of a number of writers on engineering matters and graphics but for some reason, probably the labor and expense involved in its construction, its actual use has been rather limited. Where it has been used it has in some instances been fruitful in good results and has thrown much light upon obscure phenomena. In this connection its chief value has probably come from the facility with which we are able to detect maximum and minimum conditions and rates of change among variables whose relationship is complex or unknown. Often we must deal with conditions where no known equations will connect our experimental results and where a mere tabulation of figures will not yield the desired information without much tedious study. The well recognized superiority of any graphical representation over an equation or table in conveying a clear impression to the mind of the way in which a set of variables is related will often in itself be a sufficient justification for the use of this type of chart.

Between the solid model and the plane chart there is a borderland occupied by types which do not truly belong to either and which are really plane projections of solid models. They may be orthographic, isometric, perspective or, generally, axonometric, according to the taste of the maker or the exigencies of the subject.

The orthographic projection here referred to is the topographic map projection in which the relief of the model is indicated by a series of contour lines. Each line passes through a series of points at the same elevation and is numbered to show this elevation. Only a slight effort of the imagination is required to give a very good idea of the undulating surface which they represent. The familiar weather map is a good example of such a chart. Here points of equal barometric pressure are connected by curved lines called isobars. Charts of this description have been much used to record tidal phenomena, magnetic observations, etc., and also in the presentation of vital and financial statistics.

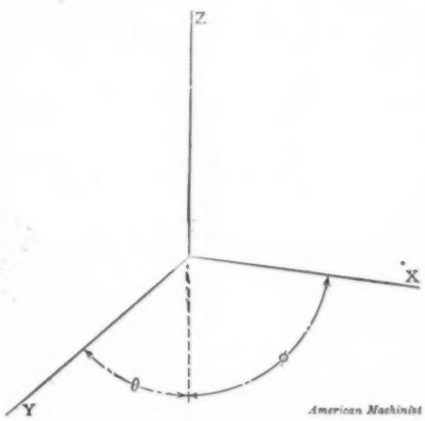


FIG. 1. AXES AND ANGLES FOR AXONOMETRIC PROJECTION

Axonometric projections will usually be found superior to the topographic in bringing out clearly the shape of the surface and are not at all difficult to construct. The special case where the projection is isometric was very fully dealt with by Prof. Guido Marx in the AMERICAN MACHINIST, Volume 31, Part 2, page 701.

Any of the other well known methods of rectangular axonometry or of perspective may, of course, be applied to these figures. As these methods are generally understood or may be found described in almost any good text on projection or descriptive geometry, no attempt will be made to discuss their principles here.

The accompanying table may, however, be convenient for reference as indicating the proper choice of angles for the axes to conform to the scale units most commonly used.

The letters in the table refer to the same symbols in Fig. 1 and the scale values, designated by $u$, represent the ratio of sizes for a unit length on each of the axes.

| Ratio of Unit Lengths $u_x : u_y : u_z$ | *Tan.* $\phi$ | *Tan.* $\theta$ |
|---|---|---|
| 1 : 1 : 1 (Isometric) | $\phi = \theta$ | = 60° |
| 2 : 1 : 2 | 8 : 1 | 8 : 7 |
| 3 : 1 : 3 | 18 : 1 | 18 : 17 |
| 4 : 1 : 4 | 32 : 1 | 32 : 31 |
| 5 : 4 : 6 | 5 : 1 | 3 : 1 |
| 9 : 5 : 10 | 11 : 1 | 25 : 8 |

TABLE OF RATIO OF UNIT LENGTHS ON THE AXES AND ANGLES OF THE AXES FOR AXONOMETRIC PROJECTIONS.

The question of scales in the projection of such figures as we are now considering is, however, of relatively little importance since the units used on the different axes have generally no relation which makes any special scale ratio necessary. The angles for the axes, on the other hand, should be so chosen as to agree, approximately at least, with those given in the table, otherwise the figure may have an awkward and unnatural appearance.

### AXONOMETRIC CHARTS

But one simple illustration will be given for this type of chart which will, however, show some interesting and rather unusual features. It is taken from the *Zeitschrift des Vereines Deutscher Ingenieure* for December 27, 1902, and occurs in an article by O. Lasche on the friction of journals with high surface velocities.

Fig. 2 was redrawn from a chart given in this paper with a few unimportant modifications to render it better adapted to purposes of illustration. The chart was constructed from data obtained from experiments on a nickel-steel journal running in a white-metal bearing and is intended to show the relation between the temperature of the bearing in degrees Centigrade, the surface velocity in meters per second and the heat generated per square centimeter of effective projected area, expressed in heat units, and also in meter-kilograms per second.

The experiments were made at a specific pressure of 6.5 kilograms per square centimeter, but since, with the lubrication used, the product of the specific pressure and the coefficient of friction was sensibly constant over a considerable range, the results are said to be applicable to any specific pressure from 3 to 15 kilograms per square centimeter.

In laying out a chart of this description the three coördinate axes and their planes are first drawn and the former

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properly graduated between the limits set by the experiments. From the graduations on the ground plane axes perpendiculars, lying in the ground plane, are drawn, thus giving a checkered surface on which points may be located as is done with ordinary section paper. At the points thus found perpendiculars are erected to the ground plane, their hight being so taken as to represent the value of the third variable. The tops of these lines are now connected by suitable curves, which must lie in the surface we are seeking and which are assumed to represent it.

be small on account of the small temperature difference. The heat produced therefore goes to warm the bearing, but as its temperature rises the heat generated becomes less and the radiation greater until we reach a point where the radiation just balances the heat production and the temperature remains stationary.

The question naturally arises as to whether it is possible to tell where this point will be. If the necessary experimental data are at hand it may be done on the chart. Suppose we have this data and from it construct a second chart on

to the ground plane gives us the line *i d j*. Any point in the ground plane, projected from the temperature and velocity axes, which falls in front of the line will indicate that under these conditions the radiation is greater than the heat generation or that natural cooling will be effective to keep the bearing below the chosen maximum temperature. Points which fall beyond this line correspond to conditions where artificial cooling must be resorted to.

Suppose, for instance, we take some point, such as *c* on the line *hcj*. Project it to the ground and we find that it falls

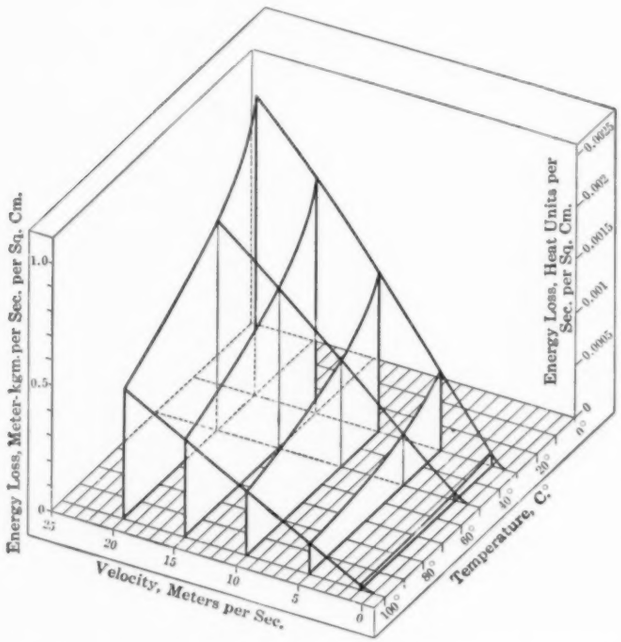



FIG. 2. AXONOMETRIC CHART SHOWING RELATIONS BETWEEN JOURNAL BEARING TEMPERATURE, SURFACE VELOCITY AND HEAT GENERATED

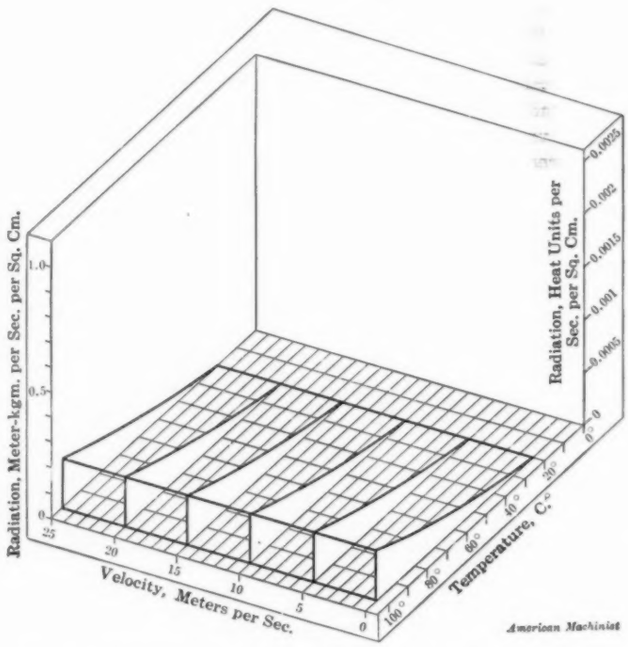



FIG. 3. AXONOMETRIC CHART SHOWING CAPACITY FOR HEAT RADIATION PER UNIT OF EFFECTIVE PROJECTED AREA OF JOURNAL BEARING

In the chart under discussion five different curves were drawn parallel to the temperature-heat plane, and then, to bind them together and render the shape of the surface more apparent, three more curves were drawn at right angles to the first and parallel to the velocity-heat plane. Taking one of these latter curves, that corresponding to 50 degrees, we see that at this constant temperature the heat generated by friction increases with increasing velocity, not exactly in direct ratio with it, however, since the coefficient of friction does not remain quite constant as the velocity changes. Keeping the velocity constant and varying the temperature, we see that the heat generated by friction decreases as the temperature rises, rapidly at first and then more slowly.

It is evident from the chart that with the journal in question the heat produced by friction will be greatest when it is starting up and the temperature is low. Also that at this temperature the radiation to the surrounding atmosphere will

the same heat, temperature and velocity axes as before. See Fig. 3. It shows the capacity for heat radiation per square centimeter of effective projected area for the bearing we are considering and is constructed for a room temperature of 20 degrees Centigrade. When the bearing has this temperature its radiation is, of course, zero. The radiation is independent of the velocity of the journal and this is indicated by the fact that the surface is a ruled one composed of straight lines parallel to the velocity axis. Increasing bearing temperature means, of course, increasing radiation.

Next suppose these two charts to be combined as in Fig. 4. It is apparent that the two surfaces will intersect along some line as *h c j*, the location of which is easily found by the rules governing this form of projection.

Any point on this line will correspond to some temperature and velocity at which the radiation just equals the heat production, the necessary condition for constant temperature. This line projected

at the intersection of ordinates from 80 degrees on the temperature axis and 5 meters per second on the velocity axis. Under these conditions the temperature will be steady.

Next suppose that we arbitrarily fix the upper limit for temperature at 80 degrees, and that we have a velocity of 10 meters per second.

Entering the radiation diagram on the 80-degree line at *a* we run up till we reach its surface at *b*. Then, following the surface along the line *bc*, we find its intersection with the 10 meter plane of the friction diagram at *e*. Through this point a perpendicular is drawn to the ground. The length *fg* on this perpendicular measures the heat generated by friction, *ef* is the amount carried off by radiation, while *eg* represents the remainder which must be artificially removed by circulating a current of water, oil or air around the bearing.

The writer of the article from which I take this illustration goes on to show how, after measuring *eg* in heat units,

a very simple calculation will give the amount of cooling fluid.

It will be apparent from the foregoing description that the axonometric projection has some advantages over its solid prototype from the facility with which we can project *through* the figure in case of need. Special attention should also be directed to the use which has been made of the line of intersection of the two surfaces. It is a rather novel feature and one which should prove valuable in many engineering problems.

### The Solid Model

Next let us consider the true solid model. It has received attention at the hands of several eminent writers, among them the late R. H. Thurston. He published a number of articles explaining its uses and advantages, among which articles may be cited one on glyptic models in the *Transactions*, American Society of Mechanical Engineers, for 1898. He appears to have been much impressed by the possibilities it offered for the solution of a certain class of problems and he illustrates its application by a number of examples.

In spite of his optimistic views as to its value, the solid model has never seemed to "take" well; at least there are relatively few recorded instances of its use. This may be partly due, as was observed before, to the labor involved in its construction, but possibly, also, to a lack of sufficient exploitation.

These models may be made in various ways. Wood is a suitable material where the surface to be produced is sufficiently regular, but this is not often the case. Ruled surfaces may be produced by strings stretched on suitable frames, but the material most generally used is plaster of paris. After the first model is made, replicas may, of course, be cast in any suitable metal or material. Cardboard, as will be shown later, is a cheap and convenient substitute for some of the above-named materials.

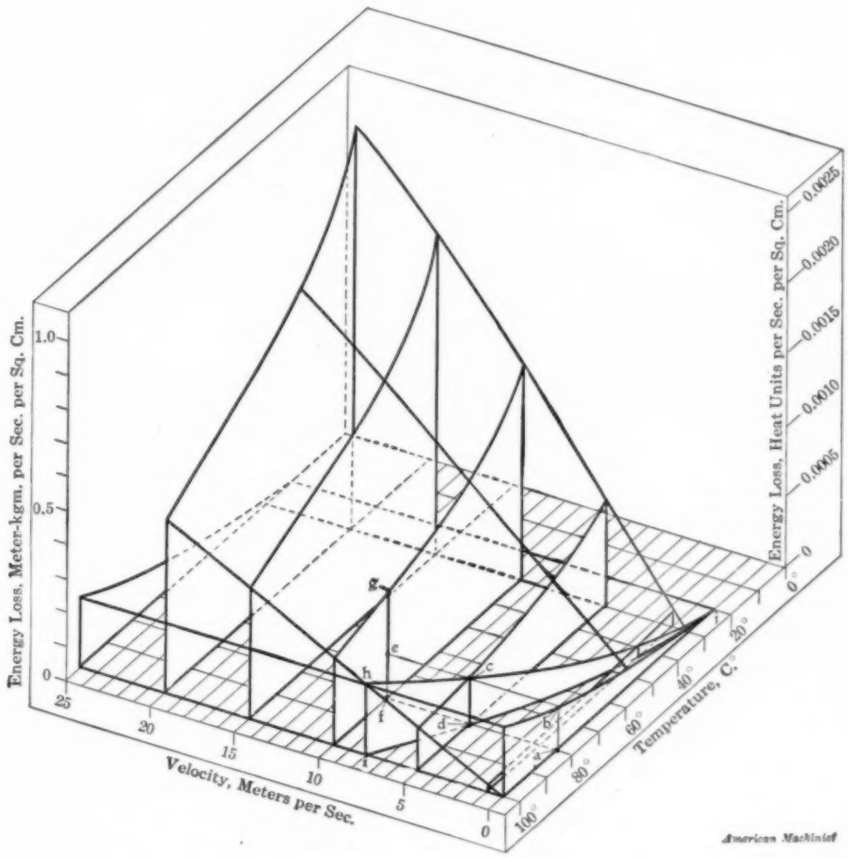



FIG. 4. CHART COMBINING CHARTS OF FIGS. 2 AND 3

In making the plaster of paris model, we first stretch a sheet of section paper on a board and lay off on it the points corresponding to two of the variables in the usual manner. At these points we next insert vertical wires which are cut off at hights corresponding to the third variable. A box is then formed around the whole and wet plaster of paris is poured into it until all the wires are covered. After it has set the upper surface is carefully cut and smoothed away until the tops of the wires are exposed and the resulting surface is taken as the graphical representation of the law connecting the variables.

A comparatively recent example of such a model is found in an article on the mixture ratio for gas engines in the *Zeitschrift des Vereines Deutscher Ingenieure* for September 14, 1907.

This model is represented in Fig. 5. It is based on data obtained from a gas engine running at four horsepower on producer gas, and is intended to show the relation between the heat units per hour per brake horsepower, the compression pressure in atmospheres and the volume of mixed gas and air per 1000 heat units of lower heating value.

The front horizontal axis is graduated to represent the cubic meters of mixture per 1000 heat units and extends from about 1.7 cubic meters to 3. Perpendicular to this axis, and also horizontal, is the axis for compression pressures graduated from back to front between 4 and 13 atmospheres.

The vertical axis is used for the heat units required per brake horsepower-hour, the graduations beginning at 2500 at the ground plane and running up to 5000.

The hollowed surface in the middle of the model covers the range within which the experiments were conducted, and the cut-off portions at the sides of the hollow have no meaning.

Without in any way attempting to discuss the conditions under which the experimental results were obtained (since this would be outside the province of my article), we will take the model as it stands, and see what conclusions may be reached from a simple inspection of it.

The bottom of the valley indicates the lowest heat consumption per horsepower-hour in any given locality.

The intersection of the valley with the back vertical plane is a curve somewhat resembling a parabola with steeply rising sides. As we come toward the front the curves cut by parallel vertical planes flatten out and the vertex of the curve becomes lower, indicating a smaller heat consumption as the compression increases. At the back of the model the lowest part of the curve is tangent to a horizontal line at about 4100, while in front it touches 3100.

It will also be noted that the slope of the bottom of the valley is steepest in the rear and is nearly horizontal in front, indicating a more rapid gain in heat economy from increased compression when the original compression is low than when high.

The bottom of the valley shows a tendency to drift to the left as we come forward, indicating that with increased compression the best economy was obtained by increasing the dilution of the mixture. The flattening out of the front part of the valley indicates that as compression increases the necessity for an exact mixture ratio for good economy becomes progressively less important.

These points are all interesting, and while they might have been discovered

from an inspection of a series of curves or of the tabulated data, it is clear that the model has greatly simplified the process of deduction, and has thus justified its construction.

### Cardboard Substitute for the Solid Model

Reference has been made above to the cardboard model as a cheap substitute for the solid type. The next illustration will be an example showing its construction.

If we assume one of three variables to have different constant values, we get a series of plane curves connecting the other two. Then, by doing the same with one of the other variables, we get a second series of curves for planes at right angles to the first. Each of these curves is cut from a piece of cardboard and slit half way up or down the lines of intersection with the cards at right angles to it. They are then fitted together something on the principle of an egg box, and the result will be a series of plane curves, properly spaced with reference to each other, all of which lie in the surface we are trying to represent. It is evidently closely related to the axonometric projection previously described.

Such a model is shown in Fig. 6. It was constructed from the curves given in a paper in the *Transactions*, American Society of Mechanical Engineers, for 1904, by E. S. Farwell, entitled "Tests of a Direct Connected Eight Foot Fan and Engine." These curves were chosen chiefly on account of the irregular hilly character of the surface to which they belong as affording a good test of the method. They occur in Fig. 39, of the article referred to, and are supposed to show the relation between the efficiency of the fan and the area of the outlet opening for various speeds, the area of opening being designated as a percentage of the product of the fan diameter by the width of periphery.

Eight different curves are given for eight different speeds, which advance by steps of 25 from 50 revolutions per minute to 225 revolutions per minute. The curves shown in the figure had the efficiencies plotted as ordinates, and the outlet-opening percentages as abscissas, and were used as they stood for one set of cards. Then taking the intersection of these curves with one of the perpendiculars to the outlet axis we get a series of lengths which we use as equally spaced ordinates for a curve at right angles to the plane of the original drawing, the ordinates again representing efficiencies while the abscissas this time are velocities. As many similar curves as were deemed necessary were taken from the other perpendiculars. All were cut out and fitted together, forming the model shown in the photograph. Such a model may be applied to many, if not most, of the purposes for which the solid type is used and has a decided advantage in simplicity of construction.

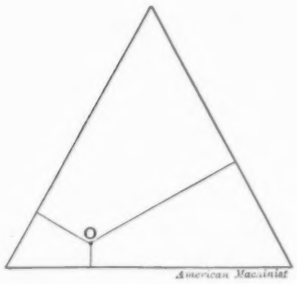



Fig. 7. Diagram Illustrating Principle of Tri-axial Solid Model

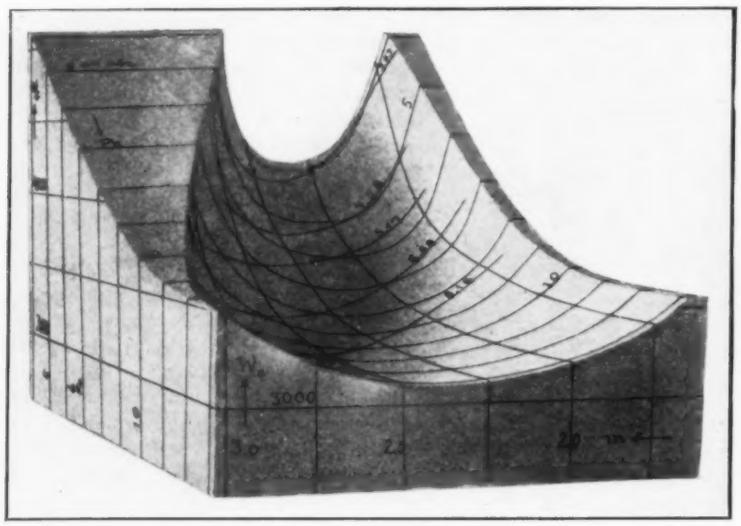


Fig. 5. Solid Model Showing Relation between Heat Units per Hour per Brake Horsepower Compression Pressure and Volume of Gas Mixture for a Gas Engine

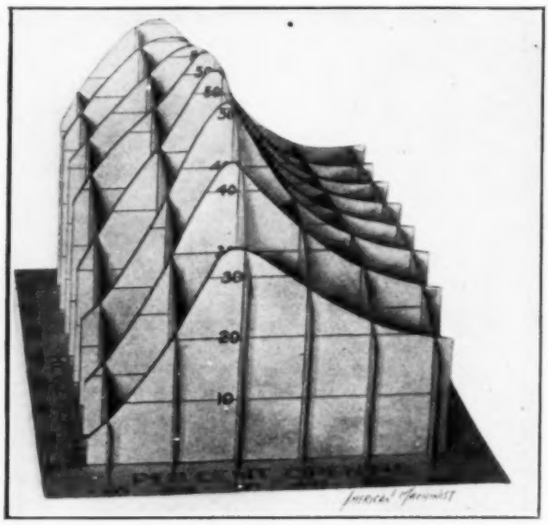


Fig. 6. Cardboard Model Substituted for a Solid Model

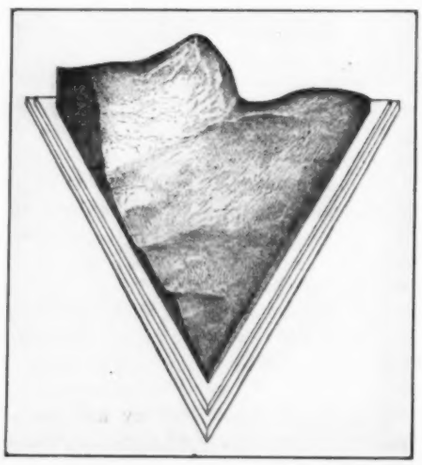


Fig. 8. Professor Thurston's Solid Model for Copper Alloys

### The Tri-axial Model

Before leaving this subject a brief reference must be made to an ingenious form of solid chart described by Professor Thurston in several of his articles. It is called the tri-axial model. By its use it is possible to take into account four different variables instead of three as was previously the case. It is a necessary condition, however, that for each set of corresponding variables three of them should add up to a constant value, generally 100 per cent. The fourth is unrestricted. These models have been very useful in representing the properties of ternary alloys, furnace slags, etc. If we have an equilateral triangle as shown in Fig. 7, and from any point $O_2$ within it we drop perpendiculars to the three sides, geometry tells us that the sum of these perpendiculars is constant wherever the point may be located.

Therefore, if we wish to study the al-

loys composed of, say, copper, tin and zinc, with reference to any property such as strength, ductility, hardness or melting point, a large number of experiments are made with specimens of varying composition and the value of the quality we are studying tabulated with the composition of the alloy.

This composition is expressed for each constituent as a percentage, and the three percentages necessarily add up to 100.

Laying out a triangle whose altitude to some scale is 100, we designate one side as copper, another as tin and the third as zinc. Parallels are then drawn to the sides distant from them by amounts corresponding to the percentage of each metal in the specimen. The scale in which these distances are measured is the same as that which was used in laying off the altitude of the triangle. These three parallels must meet in a point which is taken to represent the alloy in question. Perpendicular to the ground plane at this point we insert a wire whose length represents the value of the quality we are studying. When all the wires are fixed the whole is covered with plaster of paris, as explained before, which is then pared down to the tops of the wires.

The resulting model is shown in Fig. 8, and from it Thurston found that the strongest alloy had a composition of Cu = 55 per cent., Zn = 43 per cent., and Sn = 2 per cent.

Models of this description are evidently of especial value in the study of metallurgical problems and are by no means uncommon, particularly in that field of work.

Often, however, instead of the solid model, a topographical chart of it with the necessary contour lines is plotted, which answers many purposes almost equally well and commends itself for use in a great many cases.

# Development of Metal Working Industries in China

From a long article upon the industrial development of China, by Dr. Waldemar Koch, Charlottenburg, Germany, in *Techik und Wirtschaft*, Berlin, we translate a section which relates to the metal working industries, as follows:

Metal working has been known in China since ancient times, and to a certain degree it has developed. The iron produced has been used by foundries, needle-smiths and wire-drawers. Larger works did not formerly exist, though, naturally, there was a local concentration in the branches of iron manufacture. Thus, there were at Nan-tsun, hundreds of such small workshops; at one time Tai-yang supplied the whole empire with needles, which were soft, flexible and unpolished, so that they were readily displaced by foreign products. Finer steel was manufactured into swords, razors and knives in Hwaiking. Some European steel is now employed for this purpose.

Modern works developed partly from repair shops, partly from arsenals. With the introduction of steam navigation, of various manufactures and of railroads, came the need of shops in the country for their maintenance. Such shops soon arose along the coast, rivers and roads. Railroad companies progressed in the operation of repair shops, which soon undertook new construction. Other enterprises gradually attained a like degree of development. Today steam engines, boilers, locomotives, railway cars, engines, bridges and steamships are built in the country. All the large factories remain under European management. There exist a greater number of medium and small-sized Chinese works, especially hardware manufacturers, which commonly are called "engineers and boiler makers," but which execute such orders as come to them, so well or so badly as they are able, in the rule at low prices. Many of them also deliver simple machines, such as oil presses, rice hullers, cotton cleaners, etc., yet generally these are even worse than the Japanese products, which outdo all others for ephemeral nature. Yet they meet the demand for cheap machines, which exists in China more than elsewhere because of a poor understanding of service conditions.

Among ship-building companies, the largest is the Shanghai Dock and Engineering Company, founded in 1901, and having a capital of 20,000,000 marks. It possesses five docks, the largest of which is 170 meters long and can accommodate any steamship that can reach Shanghai. In the yards are constructed coasting steamers, paddle wheelers, lighters, tugs, launches, dredges, floating-cranes, etc. There have been built, also, five Yangtsze steamers of the North German Lloyd and Hamburg-American lines. Marine engines, pumps, tools, stationary engines, etc., are produced at the machine shops, whose principal building measures 60x44 meters (197x144 feet) and is provided with traveling cranes and all modern machinery. The same may be said of the other workshops. The boiler shop has a hydraulic-riveting equipment, the smith shop a four-ton steam hammer. The management of the undertaking is in the hands of about 50 Europeans, principally Englishmen. The works, which in 1904 declared a 12 per cent. dividend, have more recently been working a little less profitably, owing to the weakness of the freight market.

### A Purely Chinese Shop

Among other works at Shanghai may be mentioned one which is purely Chinese, that of Nicolas Tsu, in which is employed not a single Englishman, although there are several Chinese engineers educated in France. The proprietor and manager of the undertaking is also comprador of the French bank. About 400 workmen are employed. The shops are tolerably well built. They are producing small steamboats with engines and boilers, stationary engines, machine tools, coining machines for the Imperial mint, presses, iron bridges, passenger cars (for example, for the Shanghai-Ningpo road), etc. The enterprise is more a machine manufactory than a shipyard. In the vicinity of Shanghai are found the Kiangnan Dock and Engineering Works, which originally formed a part of the Kiangnan arsenal but are today a private undertaking, although managed by an admiral. They employ about 2000 persons, have a dock 120 meters (394 feet) long, shipyard, machine shop, boiler shop, foundry, etc. The sheer crane has 60 tons lifting capacity. There are built small steamboats, engines, etc. The superintendent of work is an Englishman. A great extension of the wharf is under consideration in order that a part of the new naval program may be filled there. Whether this will actually be carried out in the next few years, is as doubtful as the naval program itself.

Outside of Shanghai are shipyards and dock plants in Amoy, in Tongku, and in Haiho, where Butterfield and Swire, an important firm of shipowners, operate a shop for their own requirements; also in Canton, where the Chinese shops turn out small steam launches. In Tsingtau, the German government has a large stationary dock plant; further, there is a private yard in which small vessels are built

### The Railway Shops

The railroad shops naturally have a narrower scope of operations, since they are occupied almost exclusively with the filling of their own needs. They were established at the time the railways were built, in order to provide for requirements that might later develop. Important are the works of the Eastern Railway in Tongshan, which annually turn out about 500 freight and passenger cars, besides locomotives. The cost of the latter was figured in 1898 at 32,000 marks ($7680). Type and weight unfortunately are not stated, yet it may be remarked that the locomotive estimates of English builders were 56,000 marks ($13,440), while the

Americans got the order at 37,000 marks ($8880). There were built at that time annually: 10-ton cars, 146; 20-ton cars, 216; passenger cars, 1st class, 10; passenger cars, 2d class, 10; construction cars, 10.

The value of the plant amounted, in 1898, to about 1,000,000 marks ($240,000).

Furthermore, a locomotive was built in Tongshan as long ago as 1880, in the shops of the Chinese Mining and Engineering Company of that time, which needed a railway for transporting coal. The government prohibited the importation of the locomotives with which it was desired to supersede mule haulage on the standard gage, almost secretly built, railway. So there was built out of an old steam hoist and other scrap, a locomotive which actually worked and became the pioneer of western engines. This "Rocket of China" was the real path breaker.

### Government Works

The second group of works of this class includes the government workshops, the arsenals. These are found in Shanghai (Kiangnan), Tientsin, Hankow (Hanyang), Nanking, Foochow, Canton and Chingtu.

An impulse to their development was found preëminently in the prohibition to import arms, which the authorities imposed after the Boxer uprising. The best constructed works are those in Shanghai and Hankow. The Kiangnan arsenal employs about 3000 workmen, divided among the shops, powder factory, musket factory, cartridge factory, artillery shops and steel works. Beresford found, in 1898, some 70 cannon, which he deliberately considered to be worthy of comparison with any European. A number of tube recoil cannon with combined spring and cataract brakes, made after the Krupp model, and also a 23 centimeter (9.05 inches) marine gun of the Armstrong model were seen. Altogether, there were about 30 guns; but only a little work was done upon them since it was said to be necessary for the Ministry of War to approve the model. The artillery factory was at that time newly constructed. Among other machines built at the works may be mentioned hydraulic-pneumatic disappearing carriages. Work for civil purposes is also done there; such as the pipes for the water works of the Chinese city of Shanghai, which were cast there at 100 marks ($24) per ton. The technical administration lies in the hands of two Europeans.

The same lines of product are found at Hanyang. The output capacity of these works amounts to 15 cannon a month, and 50 Mauser rifles and 50,000 cartridges a day. The German officials are here replaced by Japanese, and in the steel works by Norwegians. Tientsin possesses also a well built shop in which engines, steam boilers, etc., are manufactured. The superintendent of work is an Englishman..

The director, a high Chinese official with large representative duties, is paid 450 marks ($108) monthly. In Nanking, the works are likewise good, but the management is Chinese and the products also. Canton possesses a factory for Mauser rifles which does other work beside. Thus, engines, boilers and transmission appliances are manufactured in the shops of the powder factory there. Foochow has, in the main, only a wharf for small boats, which might be extended. Maritime conditions require the building of larger vessels.

### Other Shops

China's metal-working industry consists at present chiefly of shops employed to meet the needs of the proprietors. Other works, employed in filling orders, have to face the surpassing competition of foreign factories. Their commercial possibilities are, therefore, limited, and the necessary result is variety in manufacture. Special factories are few. Such a one is in construction at Kinkiang. It is intended for the manufacture of tin cans for the Standard Oil Company. Another is the Yangtsze Engineering Works, intended especially for making iron bridges. Almost all large undertakings are technically managed by foreigners. The business direction, however, aside from foreign enterprises, regularly lies in Chinese hands. The smaller enterprises commonly work without foreign help; generally they attend only to repairs, installations, etc. Upon occasion, they undertake to manufacture special articles made after foreign models, since a patent protection is still lacking. Thus, there is in Shanghai a shop which produces printing-presses according to the pattern of American screw-lever presses. Another plant makes telegraph apparatus and a third, cotton-seed presses. All these works, however insignificant they may be at present, are doubtless the basis of a future machine industry. Such an industry is today impossible only because the demand for machinery Is not very great, while competition from abroad, in consequence of the low tariff, is powerful; further, there is a complete lack of Chinese technical men that are able to construct reasonably serviceable products and to manufacture them in an economic manner. Finally, there is a want of adequately trained workmen. In Shanghai, metal workers receive wages several times as great as those paid in other branches of industry. At the same time they are seldom really reliable. A good machinist is now paid 3.50 marks ($0.84) per day, and for this wage turns out work which is not by far equal in quantity or quality to that of a foreigner. For this reason machine building still remains persistently at a very low stage, even though it is surely developing. While in a few other branches of industry China may become an important competitor within a time easily foreseen, this is out of the question for the machine industry.

# A Lesson in Office Salesmanship

*By D. M. McLean*

It is interesting to observe the methods of various firms in selling their products, and considerable variation may be expected, due to the influence of personality and local customs, and ranging through various degrees of efficiency to perhaps a near approach to inefficiency. The two extremes seem to have met in an instance which came before me recently. We had occasion to send out an inquiry which was briefly as follows: A single-stage turbine pump, to deliver 400 gallons per minute against a head of 125 feet. Price to be given for single as well as double inlet. Delivery date was important and was to be guaranteed. Shipping weight and full particulars of pump to be furnished.

These requirements were submitted to two reputable builders of this class of machinery in neighboring cities, whom we will designate the A Company and the B Company, respectively. The following show the replies received, in slightly abbreviated form:

### The A Company

We would recommend for 400 gallons per minute under 125-foot head, one of our No. 4 two-stage pumps with double suction. Our price on such a pump would be $——— less ——— per cent.

We could make shipment in about four weeks from receipt of order.

Yours truly,

——— ———.

### The B Company

We do not care to recommend the single-suction pump for 125-foot head, although it might do it; double suction is much preferred, and we quote on the double-suction outfit only.

Four hundred gallons per minute, United States gallons, 125-foot head, 4-inch double-suction, Class K centrifugal, 1690 revolutions per minute, efficiency 50 per cent.; brake horsepower required, approximately 25.

Price of pump, f.o.b. factory, S——; weight, 1550 pounds; shipment, three to four weeks from receipt of order. Design similar to photograph C-124 sent with this letter. Price includes suction "Y" connection casting.

You will note that the pump has three double ring-oiling bearings, each bearing being provided with brass oil gage, and that the outfit is first class in every particular.

Yours very truly,

——— ———.

Now, we would prefer to place the business with the A Company for several reasons, but it is very evident that we cannot talk very fluently to our prospective customer regarding what the A Company has to offer, nor can we urge any "talking points" in their favor. They do not even refer to catalog page, to give us an idea of the general construction and appearance of the pump, although we know that they issue a catalog which is a model of its kind. The B Company, however, has forestalled practically all the questions our customer will ask, and although prices are somewhat in the A Company's favor, this will not count, as the B Company's pump will be bought, principally because we can tell our customer exactly what he is buying.

The recipient of such letters as the above will not buy from the A Company on the information given in their letter, and will with difficulty be persuaded to buy even after an interview with a representative of that company, if, indeed, such representative can overcome the ill effects of the letter at all. On the other hand, the letter from the B Company practically renders a visit from a representative or field man unnecessary. It is evidently the product of a competent office salesman and correspondent, and shows how the labors of the field force may be lightened by efficiency in the office staff, or how they may be increased when the field man has to overcome the inertia of his customer and in addition the effects of inertia in the home office. In the long run, efficiency in both office and field sales forces means a considerably reduced percentage for sales expense, as the field force are set free to devote themselves to the larger and more important deals, so that the same expenditure of time and money results in the end in a larger volume of business and a reduced expense ratio.

# Modern Methods of Shop Management*

*By F. A. Waldron†*

The ideal organization for the manufacturer is to carry it all in his head, money received in the left-hand pocket, money to be paid out in the right-hand pocket, to pay in cash. Then what is left is the profit, plus or minus the mental estimate of gain or loss from work in process or stock. This method eliminates non-producers, clerks, selling force, cost departments, draftsmen, promotion charges, high finance, etc.

Fortunately for the employed, a man's capacity is limited and where his business exceeds a certain amount, it is necessary for him to unload and organize to handle large problems. How can this be done with maximum profit?

The answer in part is the subject of this paper.

When you look up a timetable preparatory to a journey and find that it will be necessary to reach a certain point in order to connect with train for your destination and arrive at that point too late, the words or thoughts as the station is reached are in all probability unfit for publication. I might be pardoned for repeating one, viz: "The management of this road is rotten; trains were never known to be on time."

Yet this condition is put up with day after day in factories and customers are compelled to do the same. Broken promises and delayed shipments, I am sorry to say, have become so common that a man who really wants a delivery on a certain date has to get a duly signed and sealed penalty contract, and even then he is not sure of receiving his goods.

From the study of factory problems, I can positively state that this condition is due to inefficient management or misleading a customer to make a sale. Of course, none of those present ever do this. I am simply referring to the other fellow.

As manufacturers, you have all made good and it would be unbecoming for me to deprecate in any way the immense amount of good work which you as individuals, manufacturers and an association have accomplished and far be it from me to criticize, severely or unjustly, any of the efforts made to improve shop conditions. I beg therefore, that in what I say, it will be taken in the spirit of suggestion as to how your industries can have their earning capacity increased, labor fully rewarded, and burdens lightened without investing too heavily in plant which, in dull times, is the millstone around the industrial neck.

Having been asked by many of what the principle point in shop management consists, I was at a loss at first to find an answer. After analyzing in detail and by a process of elimination it boils down to "knowing where you are at."

## Outline of Factory Information

The organization and methods hereafter described will tell you this with reasonable accuracy and expense and economic results.

The symbol method localizes expenditurs.

The stock cards, stores or worked materials.

The time tickets, the efficiency of men and the cost of labor and machine hours.

The payroll, the expense and classification of labor.

The operation cards, sequence of work.

The instruction cards, how to do work and what to do it with.

The route cards, location of work in shop and a means of valuation of work in process.

Time study and operation analysis, establishes basic conditions.

Functionalizing of duties and increase of machine output.

Bonus for superintendent and foremen, gives coöperation.

## Weaknesses in the Shop

Study of weakness in shop organization and methods develops an astonishing lack of basic detail and truth, with a desire to play to the galleries, local and shop politics, on the part of many who desire to hold their jobs, combined with the following:

A. Incapacity for those in charge to give clear and explicit orders and instruct those under them.

B. Corresponding lack in those receiving orders to carry them out, spending more energy and time in thinking of some other way to do the work than doing it.

C. Too many minds for the orders to filter through before reaching the man behind the lathe.

D. Disregard of promises of completion of work in shop and the shipment of the same.

E. Lack of conception of the meaning of the words "thorough" and "complete."

F. Trying on of new ideas without knowing how to make them fit.

G. Patent-medicine ideas of new systems such as Highprice's Cost System, Dolittle Time System, P. T's. Premium System, etc.

H. Expecting too much from managers, superintendents and foremen and getting too little.

I. Humanity on part of managers, superintendents and foremen in holding on to the job and protecting themselves. "Self-preservation is the first law of nature."

J. Lack of specific knowledge of capacity of speeds and feeds of machines by men and foremen.

*This article, an abstract of a paper presented to the Metal Trades convention, sets forth the foundation principles upon which the striking results of reorganization in the factory of the Ross Rifle Company, published on page 527, were obtained.—Ed.

†Managing engineer, 37 Wall street, New York City.

K. Lack of detail instructions and systematic methods of seeing them carried out.

L. No system of routing work through shop.

M. Extravagant and unjudicious advertising.

N. Jealousy.

O. Lack of team work.

P. Too much brain work in proportion to hand work.

Q. Too much unused and useless information.

R. Over cultivation of the inventive mind in proportion to capital invested.

S. No method of the training of the workmen.

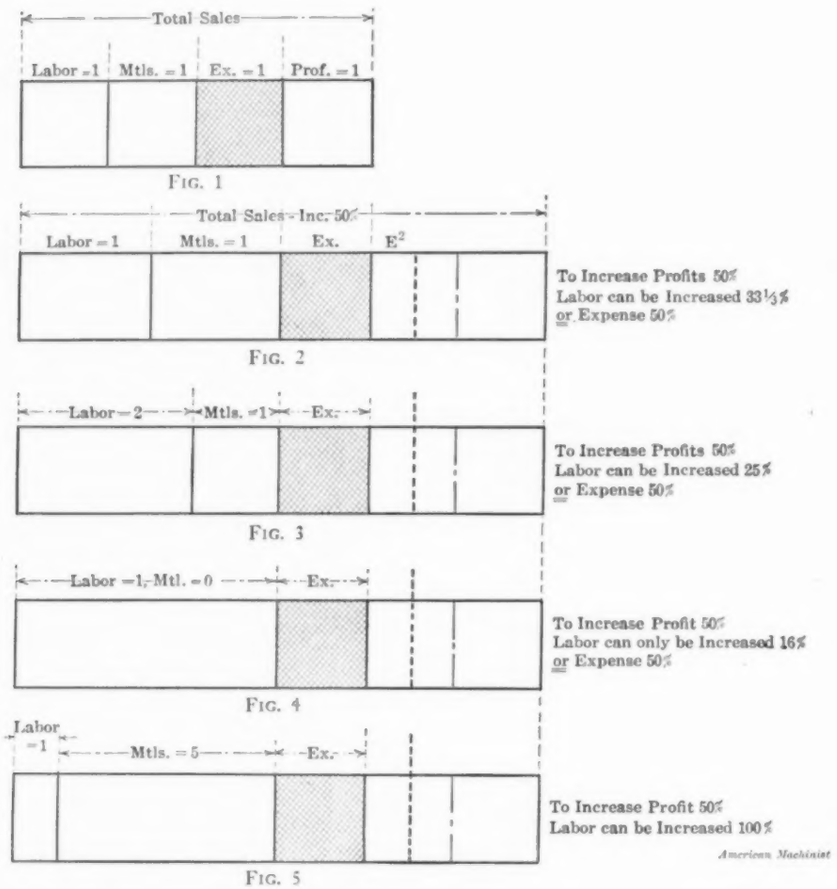



FIG. 1

FIG. 2

FIG. 3

FIG. 4

FIG. 5

DIAGRAM ILLUSTRATING METHOD TO DETERMINE BONUS AND PREMIUMS

From observation and experience covering a number of years has been evolved a method of organization for industrial work which, while it is not perfect, has shown such improvement in results over the regulation methods that I believe its description would be of interest to you. There is nothing new in it except the results, other than the coördinating of the best obtainable into an elastic organization which obtains the most direct results with the minimum number of forms and red tape and increase the efficiency, not only of the hands, but the brains of an organization by making the brains work more completely and thoroughly and compelling the machines to work harder and more constantly, thereby cutting down the time elapsing between the receiving of an order and shipping of the goods, which will necessarily reduce the value of the work in process and increase the volume of output. The time which work is operated upon is oftentimes less than one-half the time that the work lies around the shop.

### INFORMATION FOR THE MANAGER

To intelligently gage the management of a factory, the following information is necessary:

1. Capital invested.
2. Productive and betterment labor.
3. Productive and betterment materials.
4. Expense, all kinds.
5. Average annual business, past.
6. Average annual business, estimates for future.

These facts are necessary as a guide for the most efficient policy to follow in shop management. The successful manager must know them to guide him in his work.

The factory should then have the divisions as called for later and each should have apportioned to it, as nearly as possible, the expense burden it has to carry.

Next an estimate or record of the amount of productive labor and materials used in these groups or sections of the division.

### APPLICATION OF THE INFORMATION

We now have data on which to shape the policy for the first year and will proceed to apply the following:

1. Functionalize duties.
2. Form an advisory committee.
3. Control of expenditures.
4. Time study for piece rates.
5. Distribution of information.
6. Determination of premium or bonus.
7. Machine hours.
8. Routing.
   a. Operation list, stores and worked material cards.
   b. Production orders.
   c. Standing orders.
   d. Instruction card and drawings.
   e. Requisition on stores.
   f. Time card, clocks and production department.
   g. Inspection ticket.
   h. Move orders.
   i. Route card or schedule of work.
9. Payroll.
10. Analysis sheet.
11. Accounting.
    a. Symbol sheet.
    b. Proper use of symbol sheet with analysis sheet, time tickets and requisitions.
12. Costs.
13. Tickler.
14. Bonus system for superintendents and foremen.
15. Decision as to whether goods are to be made on special order or from stock.

1, 4, 6, 7, 10 are the vital points of this type of organization and concentration on these will develop necessity of the others and show gain even if carried out in a somewhat crude and amateurish manner. Time will only permit me to talk on these points.

The essential difference in this type of organization from the ordinary type is the arrangement of duties and the dividing of the technical and mechanical work from the business or hustling end of the factory more definitely than is usually done.

All designing of product, tools, issuing of lists of machines on which the work is to be done, etc., is the function of the engineering division, while the chief of the producing division pushes it along the different lines by means of the routing system, and looks ahead, anticipating where the work is to be done and that all is ready to do with at the proper time.

This insures greater rapidity in the work passing through the shop.

My observations in this have shown that a well-arranged method for routing work through the factory with duties properly functionalized increases its productive efficiency more than any premium, piece-rate or bonus system, and given the choice of only one, I should take a logical and consistent routing system to any of the others.

Take two factories exactly alike, with an oversold product, one with a good piece-rate or bonus system, and a happy-go-lucky routing system; the other with a day-work system and a first-class routing system, there is no question in my mind as to the latter showing a greater profit than the former, while a combination of the two will show results far beyond the most sanguine expectations.

### The Routing System

A good routing system automatically gives the following:

1. Basic cost information.
2. Locates a fall-down in output at once.
3. Locates all work and its condition.
4. Relieves chief of divisions of "still hunts."
5. Compels chief and assistants to "watch out."
6. Records machine hours.
7. Insures accurate time charges.
8. Insures accurate account charges.
9. Shows up delays and causes of same at once.
10. Shows work ahead for each machine and allows for rearrangement and redistribution.
11. Allows of most minute cost analysis if required; and if not, no unnecessary expense is incurred for useless or passé information.
12. Compels closer attention to details all along the line.
13. Reduces amount of wasted energy and materials.

In conjunction with above, a tickler system is most important and a shop can be run on this system alone better than on no system at all.

The tickler form is a 4x6-inch slip of paper or card, provided with a blank space for the name of the party to whom it is to be delivered, with subject and remarks. Below is a ruled space for dates on which the card is to be returned to the party whose name is on it. These cards are collected at night from a receptacle provided at desks and distributed in a filing cabinet by date; early the next morning all cards in folios of that date are taken out and distributed by a boy to those whose names appear on the card. This system is absolutely flexible and memoranda can be sent up and down the line. When once used it becomes an indispensable adjunct to the factory.

### Machine Hours

The value of an accurate record of machine hours for computing costs approaches more accurately the ideal than any other method and is of far more importance to the factory than is generally admitted or recognized.

A machine, bench or vise should carry with it, its exact proportion of the overhead expenses and it is much more important that these overhead charges should be distributed by the machine hours than charged as an aggregate per cent. to the item of labor.

This is especially true where a factory operates a large variety of machines of extremely low and high valuations.

Illustration: A machine costing $10,000 would have an annual overhead charge against it for depreciation, rental, power, etc., of $1,500 based on 3000 hours a year, or 50c. per hour. This would be as much, if not more than the hourly rate paid the man who runs it.

If the machine was run 1500 machine hours, the hourly charge would be $1.04, or double the man's time.

The universal practice of adding a certain percentage to flat labor costs for overhead charges handicaps the actual cost of the work on smaller machines and at times causes the manufacturer to discontinue making an article which shows no profit on account of its having to carry the burden of the work done on a heavier machine. The machine hour, therefore, is a very logical method for distributing the overhead-factory charges.

Another advantage of the record of machine hours is the check on foremen or superintendents applying for additional machinery when it is really additional tools that are needed, or a reasonable method of maintaining the tools and machinery which he already has.

The machine hours are a better criterion of the efficiency of production than any records of the man's time. It is the machine through which the work must pass and the more constantly this machine is operating in turning out work, the greater the volume of output becomes.

It is, therefore, important that in the selection of the machines they should be selected with a regard to the interchangeability of tools and fixtures. It is much better to spend a few dollars for tools and repairs than a larger amount for machinery.

There are many level-minded business men who will spend any amount of time and money for correct methods of bookkeeping involving a bank balance of a few thousand and yet will absolutely refuse to allow a factory to use sufficient clerical help whereby the means and methods of handling investments amounting to many thousand dollars can be increased in earning power.

I cannot blame them, however, as the method of obtaining, recording, compiling manufacturing data is an expensive luxury, especially when such data are very old or cold when they reach the eyes they are intended for. I have some rolls of paper collecting dust that have never been looked at that must have cost hundreds, yes, thousands of dollars to compile. What is required is information on the spot that costs little to obtain and can be readily filed and compiled when required. It is nonsensical to compile costs and records of questionable value and accuracy for the use of the statistical mind only unless you are sure of getting your money back in some practical way.

If basic conditions as to work in shop are right and information as to fall-down in production is caught first hand and corrected at once, the bank balance will take care of itself.

### Determination of Premium or Bonus for Workmen

The amount of premium or bonus to be paid a workman depends on the following:

Ratio of labor to material, expenses, selling price.

After assuming the amount of annual increase in business that is warranted for the condition of the market and comparing this with the producing capacity of the plant, it can then be determined from the relation of these two, as to the advisability of offering additional reward to labor for increased effort. If the plant is oversold there is no question and the amount it is oversold will form a guide for the initial calculation. Of course, additional business turned out in a given time at the same price for labor and materials will give you an increased profit, and from this increased profit it is to be decided what proportion can be divided between expense and the additional rewarding of labor.

Time study will then determine the basic condition in your factory and the above will serve as a guide as to how far you can afford to go.

This data will also show what proportion you can afford to give to your superintendents and foremen as an additional reward for closer coöperation (see Fig. 1, which shows graphically the application of the above, which can be modified to suit different conditions).

Manufacturing can be grouped into the following general divisions and all of these functions enter the manufacture of even the simplest article.

1. Engineering.
2. Producing.
3. Inspecting.
4. Accounting.
5. Maintenance.

Full authority should center on a works manager who should be an official of the company.

Competent chiefs should be selected for each division in cases where they will

have plenty to do. If the shop is small and the product simple, there can be a combination of any number or all divisions under one man. It is a very small business, however, that can afford to do too much loading up of division chiefs.

The specific duties of each should then be clearly detailed.

The organization and duties being outlined, letters of instruction are issued and forwarded to those interested so that each division may be kept in touch as to what is required of them, and also that which is taking place in other divisions.

Where new products, fixtures, plant expenses or other special expenditures are required, a letter of authorization is issued by the works manager to the chiefs of the divisions giving the information required.

An advisory committee composed of division chiefs should be organized and should meet at the option of the works manager to discuss matters relating to shop operation.

### Engineering Division

The engineering division in this type of organization is of paramount importance, and should have at its head an able and practical engineer of excellent executive ability and broad mechanical experience.

Upon the competency of this man depend the methods of manufacturing and arranging of machinery, for the following reasons.

With a thoroughly organized engineering department, manufacturing can be carried on by grouping of machine tools of a similar character. On the other hand, if there is no engineering department or the engineer is incompetent, manufacturing must be done by group methods by a variable class of machine tools, which involves a large original investment and duplication of machinery in a plant and a man above the average ability and experience in charge of each group. Such men as will attain to the highest efficiency are hard to find and the volume and quality of output cannot be obtained by this method that can be obtained by the grouping of similar tools with proper inspection. It will thus be seen that the entire economical problem of manufacture is primarily dependent on the chief of the engineering division.

### Producing Division

In this type of organization the chief of the producing division is not called upon to exercise any great ingenuity or skill on mechanical matters or detail methods of operation. These are supplied in the form of specific information by the engineering division.

The manufacturing or producing of an article commercially should not call for change of methods and operations every fifteen minutes. It should be the economical effort to turn the work out under constant pressure, a certain value for each day for every day in the year.

The instructions from the engineering department as to the routing of work, the tools to be used, the limits or tolerations which are to be worked to and the drawings for the same should be placed at the disposal of the chief of the producing division, his duty being to see that all hands and machines are working at the highest efficiency and every machine that is possible is kept running the maximum number of hours producing work. He should also see that there is as little delay as possible between one set of operations and the next.

The chief of the producing division, therefore, comes next in importance to the chief of the engineering division. On the latter depends the accuracy of the instructions to the chief of the producing division, or the path the work has to follow; and to the former, the speed with which these instructions are carried out.

In other words, the chief of the producing division should be a "hustler" rather than a fine mechanic or engineer.

### Inspection Division

The most sensitive and delicate division in this type of organization is the inspection division and its chief should be a diplomat and at the same time a man with sufficient firmness in his make-up to stand back of decisions which are made under his jurisdiction. He should be able to say "No" in such a way that it will not antagonize the entire organization.

His instructions as to inspection, gages and fixtures for testing work, are given to his division by the chief of the engineering division, and he has to see that they are lived up to. All troubles occurring in the making or assembling of the work are referred to the chief of the inspection division who decides as to the quality of the work, and, in case of serious trouble, takes the matter up with the engineering division where it is rectified, not only in itself but also where it may relate to the other parts of the mechanism.

This division has entire jurisdiction over the inspection of all raw materials, work in process, finished stock or materials, and tools, jigs and fixtures.

Where machine operations are many and particular, as to limits and finish, traveling inspectors should be placed in the factory, who pass on these operations before the machine foremen are allowed to proceed with the machining of any number of parts on any operation; also checks speeds and feeds of machines. These inspectors save from three to five times their salaries in a year by bringing up the standard of work, saving of material costs, together with accumulative profits, from increased output of acceptable parts.

They are of great assistance to the chief of the producing division and to the foreman, as well as increasing the volume of output by preventing extended operations on bad work.

On this division depends largely the smoothness with which the work passes through the shop and its cost, together with the grouping of work in assembling room ready for quick and accurate assembling. You will note that the operation of this division is dependent upon the judgment of the chief of the engineering division for the accuracy with which tolerations are determined and instructions given as to the quality and finish of work.

### Maintenance Division

The chief of the maintenance division, where the factory is large, should be a good executive mechanic with a reasonable amount of technical education. Many of the larger concerns employ a high-grade engineer to supervise this division, which furnishes plans and specifications for new buildings and equipment and handles the work of new construction as well as maintenance. Many firms consider this economical. The speaker, however, is of the opinion that the practice adopted by the textile organizations of this country in having most of their construction and engineering work done by outside parties, leaving the routine work of the maintenance to one of fair executive ability, is much more economical in the long run than to have plans and specifications for buildings and their equipment prepared by themselves.

Where the organization is not large or the duties of the chief of the maintenance division sufficient to keep him fully occupied, this division is combined with the producing division or the engineering division, preferably the latter.

### Accounting Division

The chief of the accounting division should be a man well trained in the principles of bookkeeping, a good analyist and with enough familiarity with shop methods to prevent being fooled entirely by figures.

He should be systematic and a good disciplinarian and insist upon his subordinates maintaining records to date.

With these methods, a large part of the maintaining of records is automatic and a general supervision of the accuracy of the figures and the prompt posting of the same by his subordinates are particular qualifications. In addition to the above he should watch the value of stock on hand, notifying the proper parties when abnormal conditions are approached, and see that orders are entered or cancelled as conditions require.

### Explanation of Use of Form.

The instruction card is the means of transmitting to the chief of the producing division and his foreman details as to operations, jigs, tools and fixtures, etc.,

to be used; speeds and feeds of machines and other instructions which might be pertinent to the economical and accurate production of the work.

The operation card which gives a description and sequence number of operation on the different parts and should be arranged so that it can be locked in a box in charge of the engineering division and, when changes are made in the sequence of operations, these cards are taken out and placed in their new position. This saves rewriting lists every time a change is made.

An inventory of stock on hand in store room should be taken and transferred to cards. There should be separate cards for stores and worked materials. By stores is meant all finished or raw materials kept in stock on which no work has been performed by the factory.

After the pieces for the stores have been issued and work done upon them in the factory, they are returned to the storeroom as "worked materials" and issued to the assembling room for assembling into final product. Requisitions for worked materials are not entered on analysis sheet when issued for same symbol numbers under which they are manufactured.

### Routing

I can positively state that the location of every piece of work covering 1200 operations in active circulation in a factory can be determined without hunting around the shop.

This is practically the block-signal system of the shop in which the workmen or work is the train, and the clerk in the production department is the signal man.

The man's pay is made up on his time card and no man can get a new ticket on a job until his own time ticket is returned and stamped; the new ticket being stamped out at the time the old is stamped in by a clock registering hours and tenths of hours,

The time ticket has the letters "F" and "N. F." provided on it. If a job is not finished at the end of the day, the "F" is crossed off and a new ticket made out for the man which is given to him the next morning with the same charge symbol upon it. If, however, the "N. F." is crossed off, indicating that the job is finished, the man in charge of the production department places his ticket in a box and, before it goes to the time clerk, it is marked off on the route card and an order to move work to next machine is issued for the next operation.

Move orders are not issued for operations that run in sequence on different machines of same group. They are issued, however, where work passes from one group to another or to the inspection and store rooms. The use of move orders will reduce the number of men used for trucking in the factory, 50 per cent.

The one requisite for efficient management is a simple and comprehensive accounting system, accurate in its information and inexpensive as to maintenance. For this purpose, all transactions can be captioned as follows:

1. Capital.
2. Profit and loss.
3. Production.
4. Betterments.
5. Expense.

There can be sub-divisions so as to give detailed information as requested, either by symbols or charge numbers, or both.

The analysis sheet as used in this method is a combination of a loose-leaf shop ledger and cost card. These can be taken out for any one of the charge symbols, authorization numbers or other special order numbers, the details posted thereon directly from requisition, vouchers or payroll. These sheets are then closed in the final productive accounts.

The production account sheets are credited with sales, increase in inventory and closed to profit and loss sheet.

The betterment account sheets are closed in to expense accounts and capital by a predetermined ratio or actual charges.

I do not think that the sole reason for the increase in the output cited was the introduction of the forms illustrated because you may carpet a factory with forms and not obtain the desired results. It requires intelligence to use forms, also requires a persistent, untiring energy and firmness on the part of the management to keep an organization working together with them at the start.

More diplomacy and patience have to be used in teaching those at the top than the rank and file to adopt economical and systematic shop methods In no case have wages been reduced and in every case the earning capacity of the men per day has been increased and the total cost of the product reduced.

The fundamental principles, however, are summarized in the training of the superintendent, foreman and workmen to systematic habits and convincing the officials of a company that a constant and systematic endeavor to classify and functionalize duties and route work is more remunerative than the continual harrassing of the over-burdened and oftentimes under-paid shop manager or superintendent.

Forget the ratio of non-productive help to productive and gage the efficiency of a factory by the value of output per dollar of total payroll.

# An Improved Magnetic Pyrometer

*By F. C. Mason*

We use a magnetic pyrometer, as herewith shown, that is somewhat improved, in construction, over one shown us by a steel salesman. We used both the magnetic and the Bristol pyrometer and obtain exactly the same results with each piece of steel tested.

In Fig. 1 is shown two views of the instrument, *A* being the magnet, *C* the handle, made of brass, and *B* the balance pin, made of tempered steel and hardened. Figs. 2 and 3 show the magnet and pin in detail.

The action of this instrument in use is as follows: When the steel is at the right hardening point it will have no attraction for the magnet. The magnet is perfectly balanced and hung on a knife center, the same as a scale balance. In heating a piece of steel up to the required heat and testing frequently after the heat has risen to a dark red you will observe the phenomenon of the steel attracting the magnet and throwing it out of balance. The second that the heat has risen to the right point for hardening it loses all attraction for the magnet.

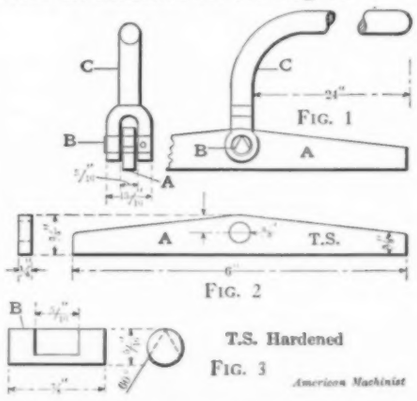



Fig. 1

Fig. 2

Fig. 3

Magnet for Hardening

To make one of these instruments you only require a small piece of air-hardening steel of the mushet quality, or in other words a steel having a large percentage of tungsten, as this has the quality of making the best permanent magnets. Any carbon steel will make a fairly good magnet. Harden this bar thoroughly hard and draw it to a light purple or about 550 degrees, and then magnetize.

This may be done by rubbing it over the pole of a horseshoe type of electromagnet, or the pole of a non ironclad type of motor or dynamo field. This type of field is the same or similar to the old Edison dynamos and motors. Another way to charge a magnet is to introduce the magnet into a tubular coil energized by a direct current of any voltage.

This instrument is extremely simple and easy to make.

# Transformetal Process of Changing Iron Into Steel

## *More Likely Results of Carbonizing Methods Greatly Exaggerated*

By E. F. Lake

The Transformetal Tool-Steel Company has recently opened offices at 71 Broadway, New York, for the exploitation of a process which it claims will change iron of all grades into steel of any desired quality. In a circular letter it is sending out, the following statements are made:

"Steel is a form of iron, and is made from iron by various processes. The 'Transformetal' process accomplishes the transformation of iron into steel of any desired quality with far greater facility and at greatly less cost than any other process. By it, also, steel is altered and improved, being rendered harder, or tougher and stronger, as may be desired, to a degree never before practically attainable.

"By the 'Transformetal' process any desired portion of an iron object may be transformed to steel, cheaply and easily, the remainder continuing as iron. Thus, the surface of iron may be changed to a steel skin of superior nature at low cost. Or the projecting parts of iron articles, or other portions subject to wear or abrasion, can easily be converted into steel.

"Steel articles may be produced having extremely hard surface portions combined with a toughened and strengthened interior. Thus, a steel article or implement may possess maximum resistance to wear or dulling, with at the same time maximum resistance to breaking. In this way, the breaking of railway axles, wheels and rails can be avoided, and these parts made to wear away more slowly under the abrasion incident to their use. Shafts for transmission of power may be made of greater lightness, with the same strength. Springs may be made lighter in weight, and yet possess greater resiliency and longer life. Armor plate and armor-piercing projectiles, agricultural and mining machinery and machine tools may be made lighter, stronger and harder or one or all of these.

"In general, by the 'Transformetal' process, pig iron, or iron castings or articles may be changed to steel of any desired quality, in whole or in part as desired, iron articles may be provided with an integral steel skin, and the qualities of iron or steel objects may be differentiated in different portions thereof, to attain maximum surface hardness with maximum internal strength or to procure any other desired characteristics for the article; and all these things may be done more easily, more cheaply, and with better results than ever heretofore possible."

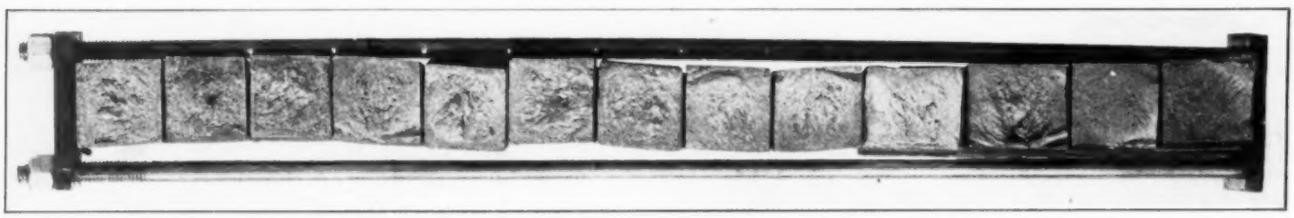


FIG. 1. SAMPLES STEELED TO DIFFERENT DEPTHS IN FROM 1 TO 13 HOURS

### SAMPLES OF METAL

The company shows samples of several different kinds of work which it claims is iron that has been steeled by this process. In Fig. 1 are shown 13 one-inch bars that have been submitted to the transformetal process for different periods of time from 1 to 13 hours. At the end of each hour up to the 13th one of these bars was taken out of the furnace and broken so that the depth of penetration could be observed.

It is claimed that the metal is placed in a furnace and surrounded with a powder that is composed of chemicals that can be bought at a nominal price at any drug store. When the furnace is filled, it is sealed up, the temperature raised to about 600 degrees Centigrade and held at that point for the time that is necessary to give the proper depth of penetration. The 1-inch samples shown in Fig. 1 have a uniform depth of penetration for each hour up to the 13th, which is the time required to penetrate to the center.

The bars look very much like metal that has been submitted to the ordinary carbonizing or cementation processes that are used for turning muck iron into blister bar. This is usually done by placing alternate layers of muck or wrought iron and charcoal into a specially prepared furnace and covering the top with a layer of clay to prevent the charcoal from burning off. The furnace is then closed and heated up slowly for a few days until it reaches a good yellow heat, at which point it is held for about nine days, in order that the iron may absorb about 1 per cent. of carbon.

FIG. 2. BAR OF STEEL GIVEN TORSION TEST

### CHEMICAL ANALYSIS

Three bars were submitted to the Midvale Steel Company for examination and these showed all the characteristics of a simple hypereutectic carbon steel.

Bar No. 1 was 1 1/32 inch square and showed a penetration clear to the center. The analysis of drillings at depths of 1/8, 1/4, 3/8 and 1/2 showed the carbon to be from 1.36 to 1.40 per cent.; phosphorus, 0.010; manganese, 0.238; silicon, 0.195; sulphur, 0.040. Bar No. 3, which was the same size, gave a carbon percentage of 1.36 to 1.39 at varying depths, with the P, 0.008; Mn, 0.231; Si,

0.235 and S, 0.051. These two bars were very similar and probably from the same stock.

Bar No. 2 was not steeled clear to the center and showed a carbon content for the first ⅛ inch of depth of 1.42 per cent.; at ¼ inch of 1.22; ⅜ inch, 1; ½ inch, 0.90. The estimated carbon content at the center was, therefore, 0.45 to 0.55 per cent.

### Physical Tests

In some tests that were made by Robert W. Hunt & Co., of New York, on a bar slightly over 1 inch square, a carbon content, by combustion, was obtained of 1.328 per cent. A tensile strength of 109,340 pounds per square inch was obtained, and an elastic limit of 77,940 pounds with no elongation or reduction of area. A cold-bending test showed a sharp fracture that was finely crystalline, with no bend.

The bar shown in Fig. 2 was given a torsion test and twisted 190 degrees in a gage length of 27.25 inches. The shearing stress on the remotest fibers was an ultimate load 109,540 pounds per square inch, with an elastic limit of 55,300 pounds and the fracture was irregular, fine crystalline. This fracture is shown on a larger scale in Fig. 3.

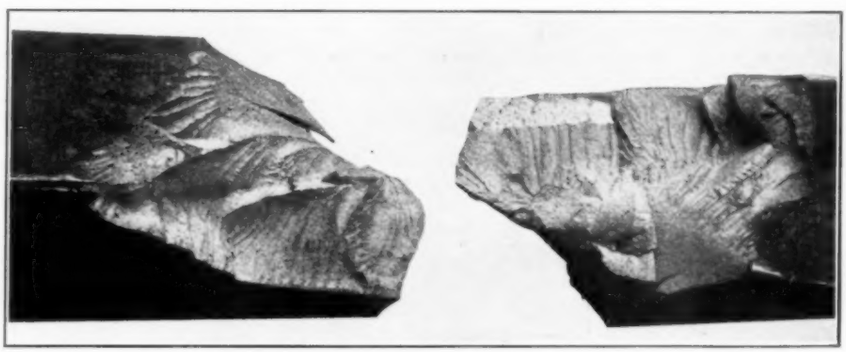


Fig. 3. Larger View of Break in Torsion Test

The point of a projectile that was submitted to this process and then broken off is shown by the two views in Fig. 4. This was one of the old-style wrought-iron projectiles and the depth of penetration was about ⅛ inch. After breaking off the point it was hammered flat and as will be seen the center was soft and ductile, while the outer shell was all cracked up by the hammer. The point was too hard to be filed and this hardness extended back about ¾ of an inch. Turnings taken from the base by the Midvale Steel Company showed the following analysis: C, 0.057; P, 0.033; Mn, 0.374; S, 0.051; Si, a trace.

### Claims Made for the Process

If the statements made above are true, namely: That a penetration of carbon ½ inch deep can be obtained in 13 hours, with a temperature of 600 degrees Centigrade, and the percentage of carbon is practically uniform at all depths, as shown by the chemical analysis, it means that a great improvement has been made in the process of adding carbon to steel from the outside, or a discovery made in the combination of chemicals that are used for carbonaceous materials.

Notwithstanding the many wonderful claims that are made for this process in the company's circular letter quoted above, it will be seen from a close analysis of the samples given and the result of the test that all the process consists of is adding carbon to iron or steel, with the necessary heat, in the presence of carbonaceous material. The principle on which they are working is a very old one and while they may have a combination of chemicals that will give a greater penetration of carbon in less time than any of the other processes, even this is doubted when we investigate some of the ridiculous claims made.

One of these is a quotation from the New York *Herald*, of August 16, that M. Martin Kallman, the president of the company, subscribed to, and reads as follows: "We obtain a great saving by our process in the manufacture of steel tools and shapes of various kinds. We can work them up in iron or cast the iron in molds and then turn it into the finest kind of steel." Another is contained in the circular letter quoted above which says: "Pig iron or iron casting or articles may be changed to steel of any desired quality."

### Cast Iron

While iron castings are very useful in many places, principally owing to their cheapness, it is a well known fact that they contain many impurities that are injurious to the metal and consequently weakening. These must be removed in order to make the ordinary grades of steel, to say nothing of the finer qualities of tool steel. It is impossible to remove these impurities and retain the density of the metal that gives it strength, without putting the iron through a melting and boiling process and adding materials that will carry these impurities off in the slag.

The iron that goes into the castings, or pig iron, contains from 3½ to 4 per cent. of carbon, and less than 2 per cent. of this will unite with the iron to form a solid solution. The balance forms graphitic carbon, or flakes of graphite that weaken the metal and also prevents it from being annealed, hardened and tempered properly. Besides this the phosphorus, sulphur and silicon are usually high and have to be reduced.

This iron cannot be changed into steel by any process that causes materials to penetrate the solid metal from the outside, and especially not by the "transformetal" process as this adds more carbon to it and aggravates rather than lessens the efforts required to change it into steel. The difference between pig iron and steel is mainly in the carbon content. Steel only contains carbon in the combined state with the pure iron; practically none of it being graphitic carbon. In fact, when enough carbon is present to form graphitic carbon the metal is no longer steel, but cast iron.

Fig. 4. Projectile That Was Steeled

Therefore, when pig iron is made into steel, from ½ to ⅞ of the carbon in the metal must be removed. This can only be done by melting it and carrying the excess carbon off in a slag. At the same time the other impurities mentioned above are reduced to a minimum by causing them to unite with the slag, and this is just as necessary in the making of tool steel as the removal of the excess carbon. If it were possible to remove the solid metal as claimed by the Transformetal Company it would mean leaving a void where they formerly existed and this would make the metal worthless. To change them to steel sounds like changing iron into gold or silver. In fact, the proposition can only deceive those who do not understand metals.

### Wrought Iron

Wrought iron, on the other hand, contains less than 0.10 per cent. of carbon and consequently is a soft ductile metal, but a considerable percentage of slag is present, and this slag cannot be removed without melting the metal. It can be made harder by causing the metal to absorb carbon, by carbonizing processes similar to the one above. The transformetal process adds carbon to the metal and makes it harder, and consequently useful for different purposes, but it does not remove the impurities in wrought

iron and consequently the strength, cutting qualities, toughness, and ability to withstand strains of various kinds cannot be made equal to the higher-grade tool steels, or even the bessemer steel, by any process that works from the outside. The physical tests given above clearly indicate this.

### Steel

The cheaper grades of steel contain higher percentages of phosphorus, sulphur, oxygen, hydrogen, and other elements, than would be allowed in the higher-priced tool steels and these cannot be removed without remelting the metal, and adding materials that will carry the impurities off in the slags. Therefore, in transforming metal by causing different materials to penetrate it from the outside means that practically a pure metal must be obtained to start with and then it might be beneficial to add carbon or some other hardening, strengthening, or softening material from the outside to improve its quality.

The process was developed by a Mr. Massot, of Germany, and the New York promoters are claiming that Fried. Krupp, the big steel maker, of Germany, are endeavoring to secure a control of this process. We have, however, just received a letter in which the Krupp Company says: "We have here been in communication with the inventor concerning a case-hardening process, of which there are many. We have broken off negotiations because of the ridiculous requirements of the owner."

While the carbonizing process is very useful for many kinds of work and has added very materially to the betterment of steel and the uses to which it can be put no one who knows anything about metallurgy would claim, unless from ulterior motives, that wrought iron can be transformed into the highest grades of tool steels or that pig iron could be transformed into any kind of steel by it, or in fact without completely changing its structure from the inside by remelting.

The possibilities of such a process sound very alluring as set forth by the promoters but, like most mechanics, we are from Missouri, and are waiting to be shown.

# Automatic Coin Feeding Device

## *Editorial Correspondence*

Many of our readers will recollect that on page 586 we published a short general statement of the fact that automatic devices are now being used for feeding coin blanks to the coin presses in the Philadelphia and other mints of the United States. Since that time we have come into possession of the views and drawings herewith reproduced, showing the construction of this device.

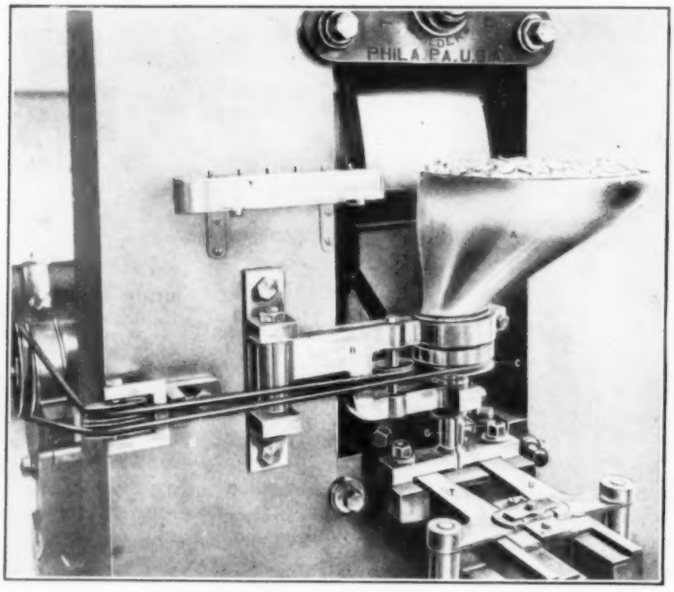



Fig. 1. Automatic Coin Feeder in Place on Press

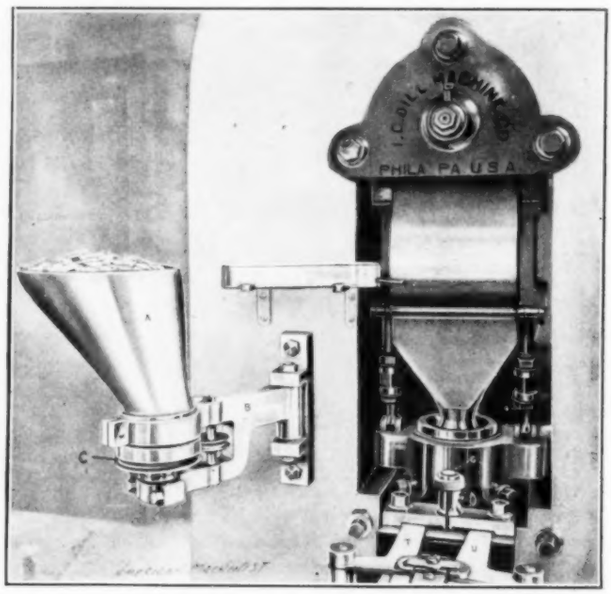



Fig. 2. Hopper Swung to One Side

Figs. 1 and 2 show, respectively, the position of the hopper when operating and its position when swung out of the way, so as to get at the press. As will be seen from Fig. 1, a round leather belt *D* coming from a belt wheel on the shaft at the back of the press, drives a pulley at *C* to continuously feed the coin blanks down from the hopper above.

Glancing at Fig. 3, *A* is the hopper and *C* is the belt pulley, just below the hopper. *E* is a hollow spindle held in the bracket *B*, as is also the hopper *A*. The pulley *C* rotates on *E* and the collar *H*, turning the plate *D*. This plate *D* has a round opening at *J* large enough to allow one coin blank to drop through, down upon the flat plate part of *E*. As *C* and *D* rotate, the blank which is dropped through the opening *J*, is drawn in toward the center of *E* by a spiral pathway in *D* shown at the right of Fig. 4, where this plate is termed the "Cent Feeder." This plate is, of course, made for other coins beside the cent when desired.

The weight of blanks in the hopper and continuous rotation of the plate *D* carry the blanks around in an unbroken line so that they finally come in to the center of *E* and drop down into the tube *G*. At the bottom of this vertical tube the fingers *T* and *U* carry the bottom blank forward into the press, where the stamping is done to convert it into a coin.

By the construction adopted there is always a positive tendency to feed blanks down the tube and into the press, due to the rotation of the feeder plate *D* and yet the feed is not so positively as to cause jamming and consequent bending of the parts. The blanks simply travel round and round on the top plate of *E* until the drawing out of the one at the bottom of the tube by the fingers, leaves room for another at the top.

Beside being possible to swing the hopper away from the front of the press so as to get at the dies, the bracket *B* is provided with a swivel pin *L* as shown in Fig. 3. This pin screws up hard into *B* and is pinned by the dowel *P*. *L* also projects into the part of the bracket *M* where a pin *S* passes through *M* and into

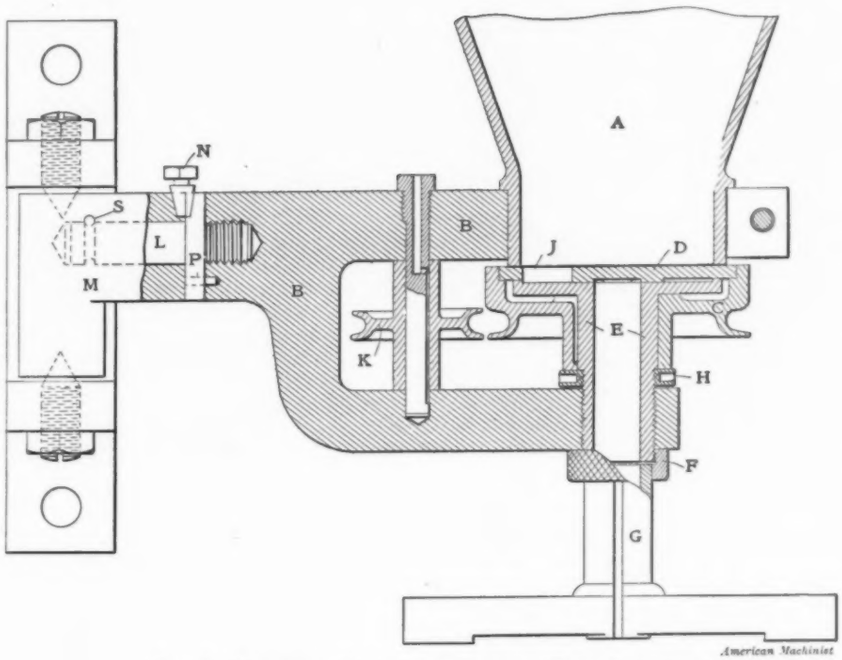



FIG. 3. ASSEMBLY VIEW OF AUTOMATIC COIN FEEDER

a groove in *L*, so as to keep the latter in place. The taper pin *N* drops down into the collar of *L* and the bracket *M* so as to hold the hopper in an upright position when in use. The object of thus swiveling the bracket and hopper is simply to dump out the contents from the hopper as quickly as may be desired, in case of any necessity to get at the parts.

There is a slot in the side of tube *G* and into this slot projects a finger from a weighted lever. When the tube *G* is full of coin blanks which are dropping down to the fingers *T* and *U*, the finger of the weighted lever rests upon the sides of the blanks in the tube. If, for any reason, the feeding from the hopper should stop, the finger in the slot will be unsupported and the weight will, therefore, cause the lever to drop. The dropping of this lever is arranged to short circuit the automatic release rheostat of the motor which drives the press. This stops the press before the tube has become entirely empty and so prevents the dies from striking together and, possibly, being injured.

It is into the tube *G* that the hand operators used to feed the blanks in little piles before the automatic feeding mechanism was devised. The hopper is large enough to hold coin blanks to keep the press running for about 40 minutes at a stretch. The actual time depends upon the speed of the press, which again depends upon the denomination of the coin.

## The New Plant of the Triumph Electric Company

About 500 business men of Cincinnati and guests helped to celebrate the dedication of the new plant of the Triumph Electric Company at Oakley, a manufacturing suburb of Cincinnati, on Saturday April 30. A special train of eight cars was run by the Baltimore & Ohio Southwestern railroad, and a substantial lunch awaited the arrival of the guests.

After the lunch an address of welcome was made by Mr. Hobart, president of the company, and several other prominent Cincinnati men made some congratulatory remarks.

Although the new plant is much larger than the old one, there are both provisions for and expectation of future enlargements to over double its present capacity. The present site includes 8½ acres, and the new shop has 125,000 square feet of floor space, which gives ample room for from five to six hundred hands.

When it is remembered that this is the outgrowth of a shop of less than 100 square feet of floor space in 1889, it gives some idea of the energy and perseverance of W. N. Hobart and his sons, as well as their ability as organizers.

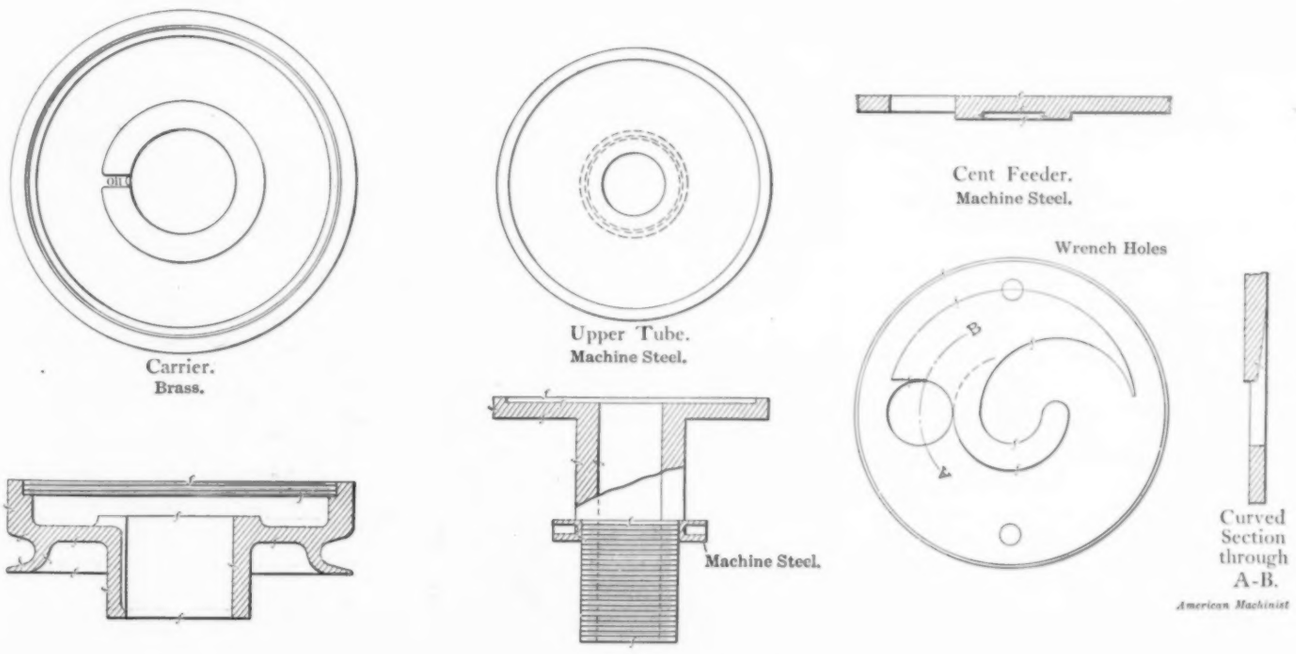



FIG. 4. DETAILS OF AUTOMATIC COIN FEEDER

# Some Machining Operations in Producing Motor Car Parts

*Accurate, Effective Methods Devised for Economical Output*

Editorial Correspondence

Many automobile manufacturers buy certain parts that enter into the construction of their cars, and this has led to the building up of quite an industry for the manufacture of parts. One of the largest companies in this line of manufacturing is the Michigan Motor Parts Company, of Detroit, Mich., and they have devised many accurate and economical methods of performing different operations on the several parts which they manufacture. A few of the more striking operations are shown in the accompanying illustrations.

Transmission gear cases are one of the products of this concern, and Fig. 1 shows the second operation that is being performed on this gear case. The gear

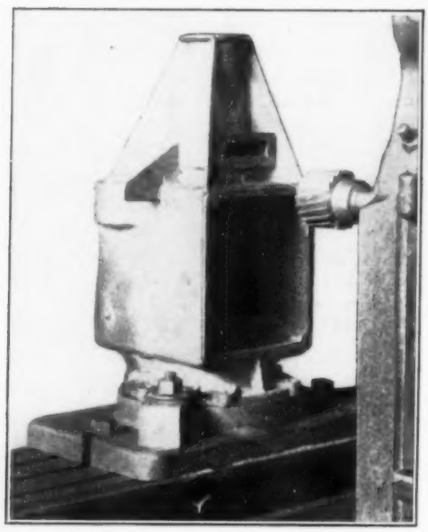


FIG. 1. MILLING COVER BEARINGS OR AUTO GEAR CASE

case is of cast iron in this instance, and the first operation is to turn off the flange and bore out the large hole in the end that locates it on the jig shown on the platen of the milling machine. This gives a starting point, and the case is then clamped down and the surfaces for the large and small cover are milled, as shown in the illustration.

### MACHINING HOLES ON RADIAL DRILL

After this the case is taken to the radial drill and located in the jig shown in Fig. 2. Here the numerous holes in that end of the case are drilled, reamed, counterbored, etc., with the tools shown in the special cupboard to the right of the machine. This cupboard is furnished with hinged doors to let down out of the operator's way, and to this is attached

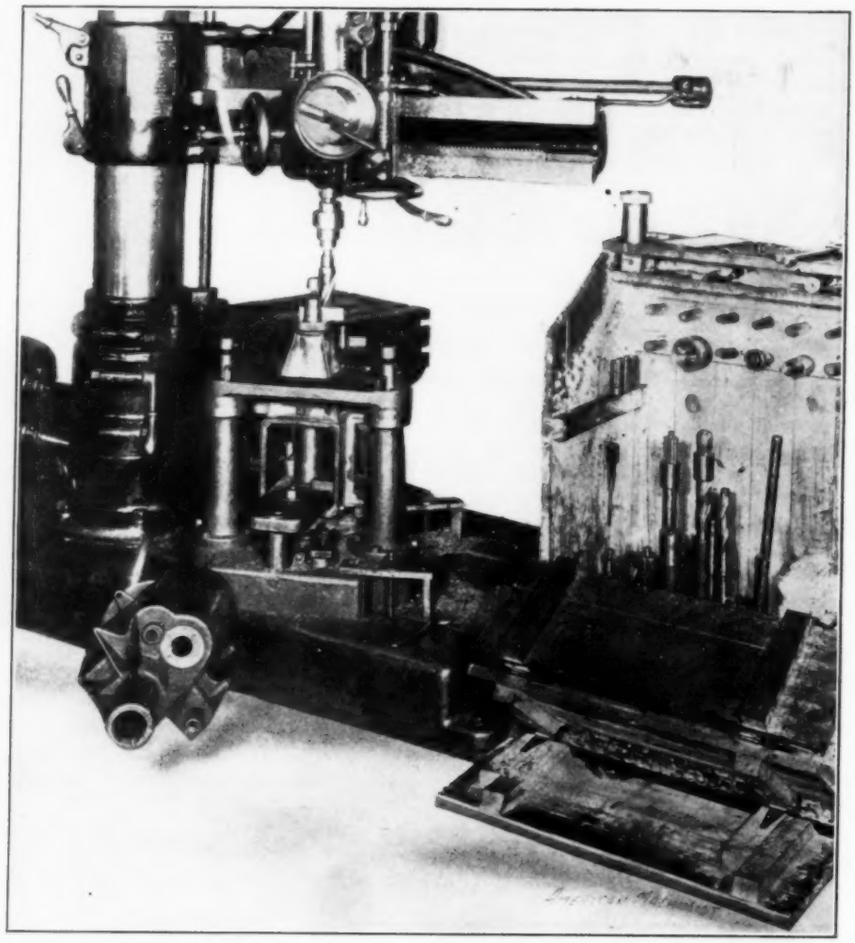


FIG. 2. DRILLING AND REAMING THE VARIOUS HOLES

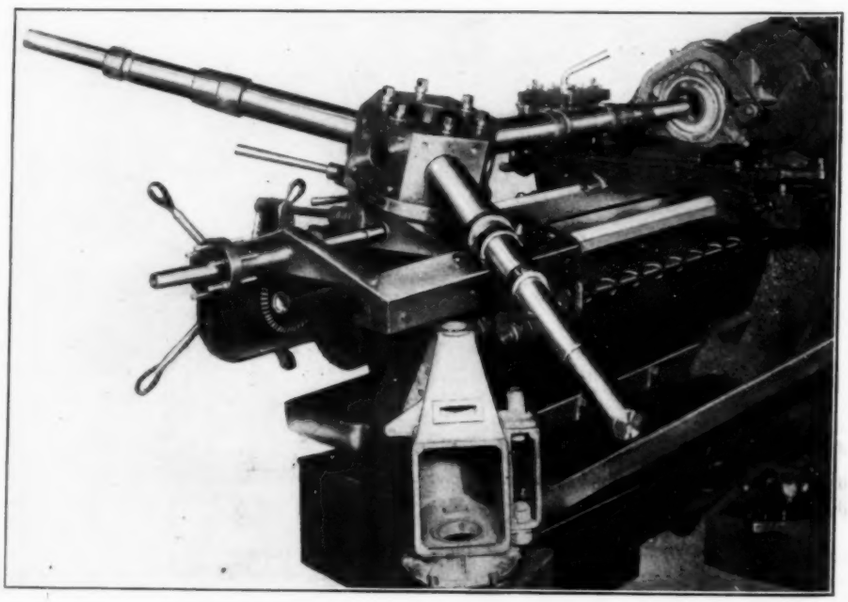


FIG. 3. BORING AND REAMING THE MAIN BEARING

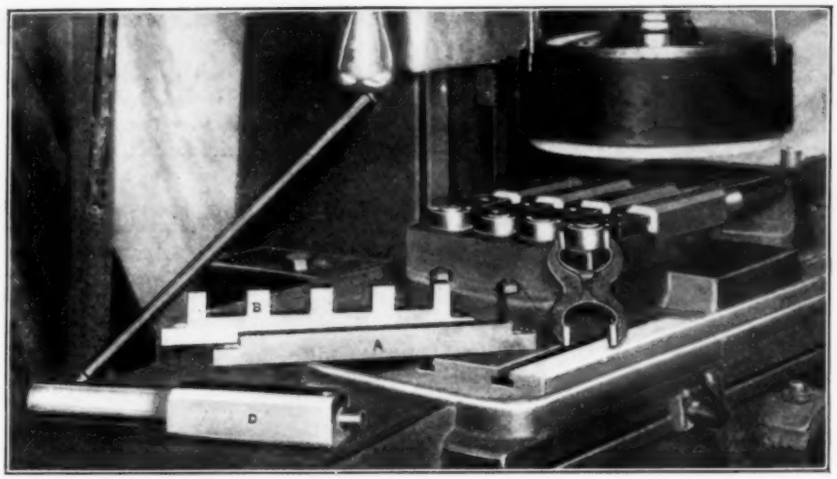



FIG. 4. GRINDING SHAFTS FOR GEAR CASE

a clasp so that it can be closed and secured with a padlock so the tools will not be disturbed when the operator is away.

The case fits over a disk in the bottom of the jig, the same as it does in Fig. 1, and the cover of the jig is then lowered over the three posts and secured with the keys and set screws. This holds the case securely in place while it is being machined. The numerous holes that are drilled, reamed and counterbored, can be seen by the front view of the case that is lying on the floor. The tools are held in a wizard chuck so that no time will be lost in changing from one tool to the other.

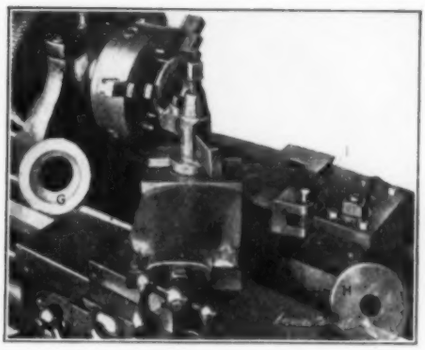



FIG. 6. TURNING A BALL CUP

the lathe, and the case is held in this by merely bringing a strap over its top and fastening it with a thumb screw. When the case is secured, it is rough bored, finish bored and reamed by the three different bars shown in the turret. Four different sized bearings are machined simultaneously by each of these bars.

### GRINDING GEAR SHAFTS

One of the gear shafts that enter into this case is shown as it is being ground in Fig. 4. These shafts are turned on centers and are then hardened and brought to the grinding surface. Here they are located on centers in the jig as shown, and each of the four sides is ground at an equal distance from the center. The centers are not entirely relied upon to hold the shafts true while grinding, as a parallel bar, similar to that shown at *A*, is placed under the center of the four shafts to prevent the wheel from springing them out of true while the first two sides at right angles to each other are being ground. When grinding the other two sides, the piece *B* is placed under the center of the shafts. When the grinding is finished, the gage *C* is used to see that the shafts are the exact size desired. In the two ends of this gage, there is a difference of one-half a thousandth in size, and one end must be a tight fit on the square part of the shafts in both directions, while the other must go on easily. A finished shaft is shown at *D*. All the other fits in the transmission case are very close, as the whole must be assembled so that

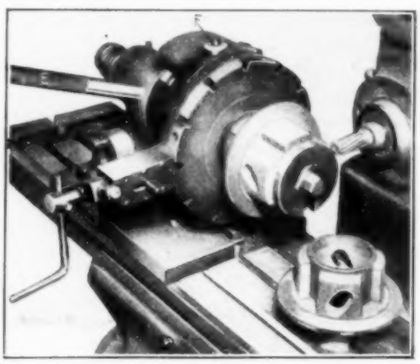



FIG. 5. MILLING BEVELED SLOTS

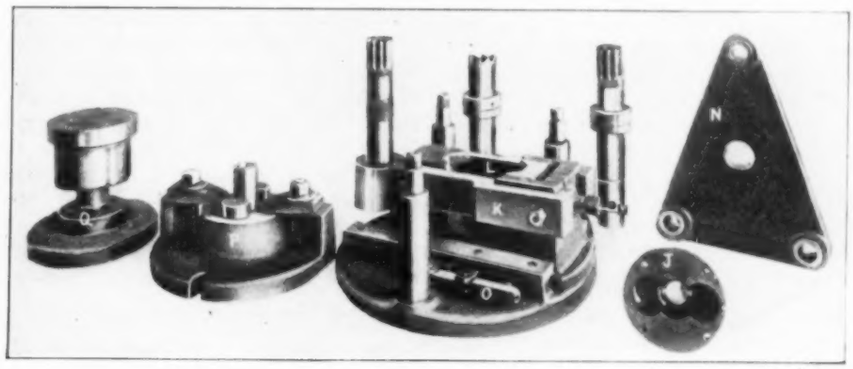



FIG. 7. JIGS AND TOOLS FOR MACHINING PIECE J

### TURRET LATHE WORK

The next operation is that of boring and reaming the main bearings on a turret lathe, as shown in Fig. 3. A special jig is clamped on the faceplate of

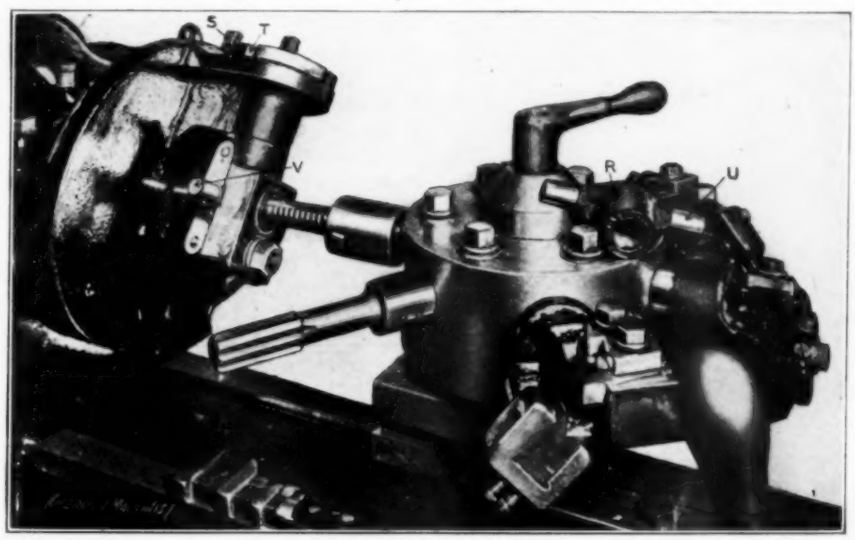



FIG. 8. REVOLVING WORK HOLDER FOR TURRET LATHE

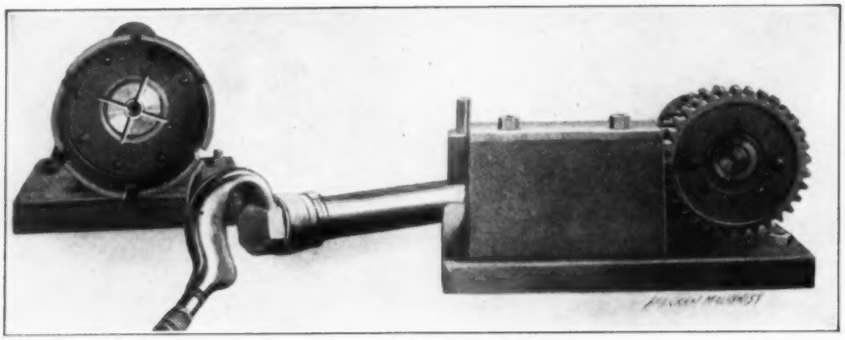


FIG. 9. JIGS FOR PNEUMATIC RIVETING AUTO GEARS AND CASE

the gears will be practically noiseless when in operation.

### MILLING BEVEL SLOTS

Another piece that is used in the transmission case for the purpose of throwing the gears in and out of mesh is shown in Fig. 5. Here the bevel slots, that are plainly shown in the piece lying on the platen of the machine, are being milled. They are four in number. Three holes are first drilled where each slot is to come, and the piece is then fastened onto the jig, as shown. The milling cutter is started working, and the handle *E* is then moved up or down, as the case may be. This makes the face plate turn over and move in or out at the same time; it being guided by the slot and rollers shown at *F*. Thus, these pieces can be turned out as fast as the milling cutter will remove the metal.

At *G* and *H* in Fig. 6 are shown the front and back of the ball race that is being held in the lathe chuck and turned. The flat and ball race are turned by making the tool carriage follow the former shown at *I*.

### JIGS FOR UNIVERSAL JOINT CASE

The jigs, fixtures, tools, etc., that are necessary to machine the piece *J* are shown in Fig. 7. In this piece the three holes that run into each other must be in absolute alinement and exact in size. For that reason the jig shown at *K* was made. The piece is put into the opening *L* and clamped with the set screw *M*. The cover *N* is then put on the three posts and fastened with buttons. The three holes are then milled and reamed through the bushing in the jig cover *N* with the tools that are behind the jig. That part of the jig that clamps the piece *J* is moved back and forth in ways.

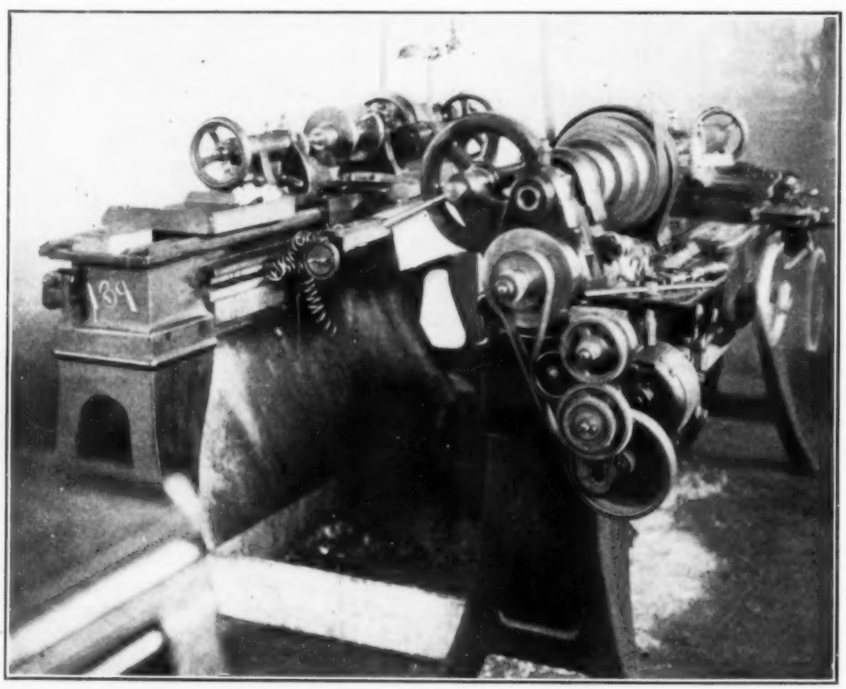
The sliding part of the jig is locked by a pin from the lever *O*, in three different places, and this brings the three holes in *J* in their correct position underneath the bushing in the cover *N*. Thus the three holes are the correct distance between centers and are in perfect alinement. After being operated on here, the piece goes to jig *P*, where the center hole is reamed and keyseated. It then goes to jig *Q* for drilling the four small holes for bolts.

### REVOLVING WORK HOLDER

In Fig. 8 is shown a revolving work holder that is used on the turret lathe for machining the universal joint knuckle shown lying on top of the turret. When the center is drilled and reamed, the work holder is revolved around until the block *S* fits in the slot *T* and the end *U* is then turned. After this, it is revolved half way around again, and the block *S* fitting in another slot not shown, brings the piece in correct position to machine the end *V*. This piece is hardened and the ends are ground to make it a perfect fit.

A simple stunt that is very effective and efficient, is that of riveting the gears and gear cases together as shown in Fig. 9. This consists of two simple jigs that are bolted to the bench next to the blacksmith's fire, and the rivets are heated in the fire and driven home and headed by the pneumatic riveters shown lying between them.

# Neat Arrangement of a Lathe Pan



A LATHE PAN

The accompanying halftone shows a neat arrangement of lathe pan arranged to take care of two Pratt & Whitney tool-room lathes at the Brown-Lipe shops, Syracuse, N. Y. The two lathes are placed back to back and have a galvanized sheet-iron pan between them. Sloping down from each of them is a diagonal sheet of iron which conducts the chips to the pan on the floor. The pan being at the back of the lathe is out of the way of the workman's feet and does not annoy him, and the diagonal pieces of sheet iron are at the top brought far enough forward to catch all the chips as they fall.

The pan is accessible from either end for the removal of the chips.

A test of nickel-steel riveted joints made from four different kinds of commercial nickel steel showed the strength of nickel steel to be about two to two and a quarter times as high as that of joints riveted with wrought-iron or mild-steel rivets. The advantage thus gained more than counteracts increased cost.

# Letters from Practical Men

Concerning the Details of Making Things in Machine Shops from the First Sketch to the Sale

## Backing Off a Spiral Fluted Hob Without Special Fixtures

The necessity of a spiral-fluted hob where the lead is great, as in double, triple and quadruple hobs, is now well known. It is just as necessary to have the cutting face of a tooth in a hob at a right angle to its cut as it is for a gear cutter or any other form cutters. As this is impossible for the full length of the tooth for a hob, being milled spiral, the calculations carried out are based upon the pitch line.

I know from what experience I have had with hobs that a hob of any great lead at all gives better results if spiral fluted instead of being straight fluted, in fact in many cases it has been altogether impossible to use the hob when made with straight instead of spiral flutes. The only reason I have been able to find for not making all our hobs spiral fluted is that we had no spiral backing-off fixture. The object of this paper is to explain simple means of accomplishing this without special fixtures.

In a lathe which can back off straight-fluted hobs we have all that is required for backing off a spiral-fluted hob.

Referring to Fig. 1;

$A\,B$ = Lead of hob.

$B\,C$ = Pitch circumference.

$A\,C$ = Length of thread of hob, hypotenuse of angle $A\,B\,C$.

$C\,D$ = Lead of flute.

$B\,D$ = Length of flute, hypotenuse of angle $B\,C\,D$.

$A\,X$ = Distance the spiral flute $B\,D$ gains on the pitch circumference $B\,C$ in one turn of hob. It also represents the number of or fractional part of a flute gained in one turn of hob.

In any hob, which has a spiral flute at right angles to the thread, or to its cut, the angles $\alpha\beta\delta$ are all equal.

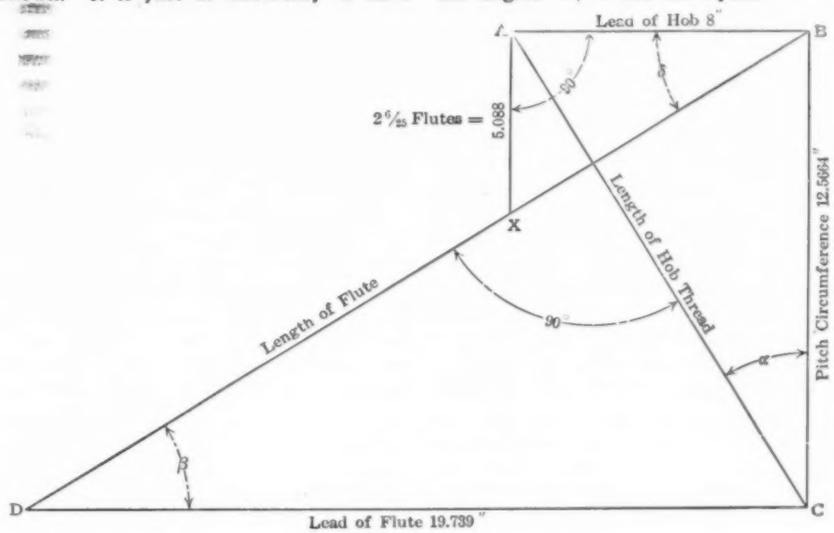



FIG. 1
BACKING OFF A SPIRAL FLUTED HOB

Referring again to Fig. 1;

Pitch circumference $B\,C = 3.1416 \times$ pitch diameter or $3.1416 \times 4$ or 12.5664 inches.

Sine angles $\alpha\beta$ and $\delta$ are all equal and we can proceed to find the lead of flute $C\,D$ to be milled in hob as follows:

$$C\,D = \frac{B\,C}{A\,C} \times B\,C, \text{ or } \frac{12.5664}{8} \times 12.5664 =$$

19.739 inches.

In this hob we are going to put five flutes. In this connection, care should be taken, as the number of flutes in a hob when spiral fluted may be less than would be the case had the hob been straight fluted, or when the lead of the flute is great.

Since our pitch circumference is 12.5664 inches and we have five flutes in hob, one flute will occupy $\frac{12.5664}{5} = 2.513$ inches of the pitch circumference.

We must now find the distance $A\,X$ which represents the number of flutes or fractional number to be added to the number of flutes cut in hob. This is found by dividing the pitch circumference by lead of flute and then multiplying this quotient by the lead of hob, or

$$A\,X = \frac{B\,C}{C\,D} \times A\,B = \frac{12.5664}{19.739} \times 8 = 5.088$$

inches.

Now since we have found that one flute = 2.513 inches on the pitch circumference and have gained 5.088 inches we will have gained as many flutes as 2.513 is contained into 5.088; $\frac{5.088}{2.513} = 2\frac{6}{25}$ flutes.

In will be found practical to change this to an even number and call it two

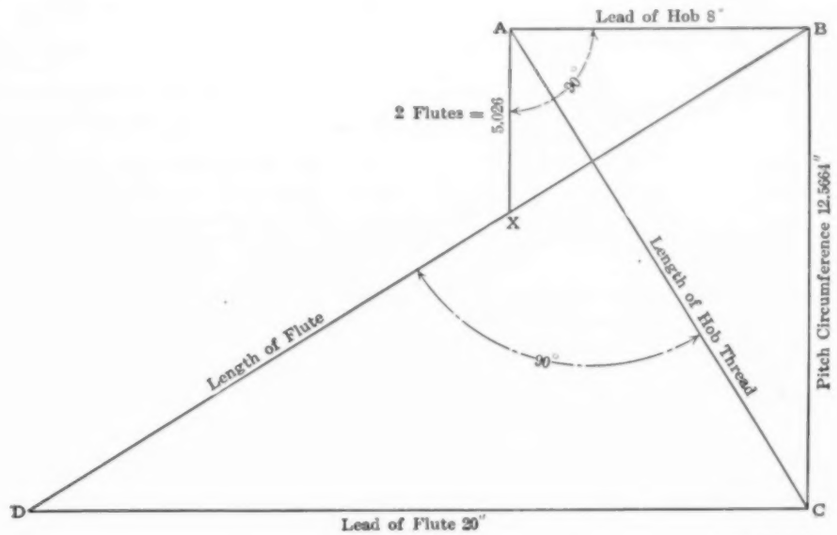



FIG. 2
BACKING OFF A SPIRAL FLUTED HOB

All we need to know of the hob is the pitch diameter and lead.

In the following example a hob 4-inch pitch diameter and 8-inch lead hob is used.

flutes. Now after finding the number of flutes gained, which in this case is two, we add them to the number cut in hob, which is five, and this gives seven flutes. Therefore, although there are only five flutes in hob we must gear up for seven to overcome the gain of spiral flute.

Always when changing the distance $A\,X$ to a number to bring even number of teeth or even fractional number that we can gear for, we have changed our lead of flute to be milled in hob so we must find what the lead of flute should be to correspond to two flutes instead of $2\frac{5}{8}$. Since one flute equals 2.513 inches, two flutes will be equal to 2 times 2.513 inches which is 5.026 inches. This is changing the distance $A\,X$ from 5.088

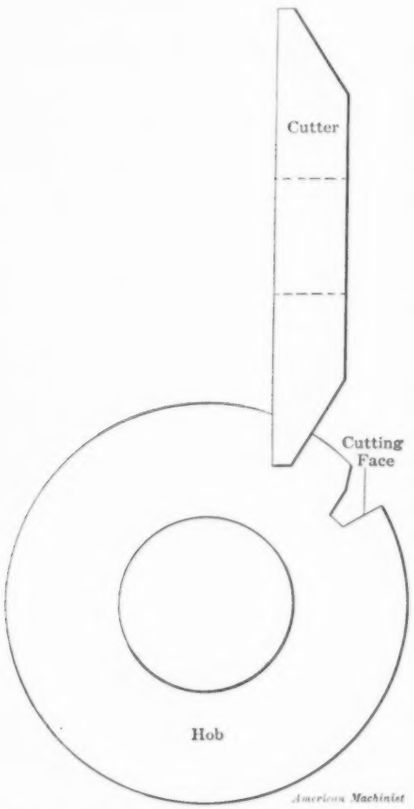



FIG. 3. MILLING A SPIRAL FLUTED HOB

inches to 5.026 inches. Now since $A\,X = 5.026$ inches we must find the distance $C\,D$ which equals the lead of flute to be milled in the hob. This is done by dividing the pitch circumference, 12.5664 inches, by 5.026 which is 2.500 times, then multiply this answer by the lead of hob, 8, which gives 20 inches. Therefore our lead of flute to be milled in hob will be 20 inches instead of the first lead found, which was 19.729 inches.

This lead, 20 inches, will not cross the tooth at exactly right angles at the pitch line but will be near enough to make it perfectly practical.

This particular hob we made and instead of gearing for seven flutes we geared for $6\frac{2}{3}$ flutes and had a hob which did fine cutting. The reason we did this was on account of not having the proper change gears for seven flutes.

Nearly always the distance $A\,X$ happens to be such a number so as not to bring even fractional parts of flutes that your change gears will care for, so we change this distance $A\,X$ to the nearest fraction your gears will cut, otherwise make gears. After doing this your lead of flute must be changed to match the distance $A\,X$. It really does not matter as to what our lead of flute comes to because milling machines as a rule have gears furnished to cut a lead near enough to what you get to give practical results.

A hob made in this manner should be chased accurately before the teeth are relieved, then back off to the cutting face. Since we are backing off teeth to the face and we found that the first tooth should be backed off to face before last tooth we do not necessarily need to cut front teeth any more, but can start tool anywhere where the teeth are not relieved quite to the face. We will find this should not occur often because our lead of flute would have to be out quite a little to cause this trouble. When not being able to cut lead exact, always select a shorter lead nearest to what you should cut, then the first tooth on hob will always be done first.

In milling a spiral fluted hob the bevel side of cutter must be used to cut cutting face of teeth on hob as shown in Fig. 3, this is so the lead of flute will curve around the beveled side of cutter, this will enable making cutting face on a straight line with center. Of course, when grinding the flutes in a spiral hob the emery wheel should be beveled same as the milling cutter.

Wilkinsburg, Penn. O. R. BRINEY.

## Two Viewpoints

Two statements have been made to me lately which are so at variance with each other and so entirely different from what might have been expected from the men who made them that they are of large interest. The first was made by the dean of a large engineering school, and was to the effect that all radical progress in mechanical matters is made by practical men as a result of slow evolution. That professional men, theorists as he called them, do not evolve anything new but simply trail along behind the practical men and pick up and classify what they have accomplished and tell the reason why they have done it.

This from a college professor!

The other man is the head of a large manufacturing concern, rated in the millions and 50 years of age at least. He was telling me about a new prime mover which they had just built, 3000 horsepower. I asked him how they had gotten up to that size; by what stages they had progressed. "Not a stage, we just plunged right in and built it."

"How much money were you risking?"

"Over $100,000."

"I suppose it was designed by men who had built similar machines for other people."

"No, it was designed by our own technical force who had had no previous experience in that line."

I told him that it seemed to me that designers were getting to have more confidence in their work than they used to. He replied to the effect that the designers had always had confidence enough but it was only recently that capitalists had had confidence enough in their designs to furnish the means by which they might go ahead. He said "These are the days of technically trained men. They grasp the fundamental points of problems and go direct to their solution, where the old, hard-headed man of experience dared progress only as a blind man feels his way across the street, feeling his way by inches. We capitalists have wasted the interest on our money for years because capital is naturally timid and we have placed it with timid men. Today we must see quick returns and those we get from technical men. If I had waited for our shop men to build a 10 horsepower model and a 25- and a 100-, 500-, 1000-, 2000- and then the 3000-horsepower machines, I would have been dead before I could see it work, and the models would have used up all the money that I risked on the machine as it was."

Curious, isn't it, how men differ in their ideas? They were both right, but one was talking of 10 years ago, the other of today and tomorrow.

It has taken years of patient effort to so analyze the results of practical effort in the strength of material and applied mechanics that a man can predict what will happen in a case a trifle out of the ordinary. Once the action of material, throughout the whole range of stress, is known, the designer can predict with certainty what he can safely do. To be sure the field has not been covered. Only scattering spots have been touchd at all, but the progress that has been made easily justifies the work that technical schools have done.

Springfield, Mass. ENTROPY.

## Wanted: a Formula

Can some reader of the AMERICAN MACHINIST give me a formula or equation to use in determining the dimensions of a trapezoidal section of ring that will become rectangular when wound into a helical spring? The formula should be based upon the modulus of elasticity of the material, the inside diameter of the coils, the pitch of the coils, and the desired rectangular section of the sine after winding.

Simsbury, Conn. A. L. PRATT.

# Discussion of the Previous Question

**Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers**

## Making "French" Press Tools

The article by F. Greiner at page 53, on a punch and die with close-fitting stripper, has interested me as I think he is "on to" the tools generally known as the French style of press tools. When large quantities of parts are required no style of blanking tools can be more suitable or give better satisfaction than these. In fact, I call this tool arrangement a cheap type of subpress and it can be used on as fine a class of work as the more expensive subpress. As I have had many years' experience with such tools, perhaps a description of how they should be made to get the best results may be of interest.

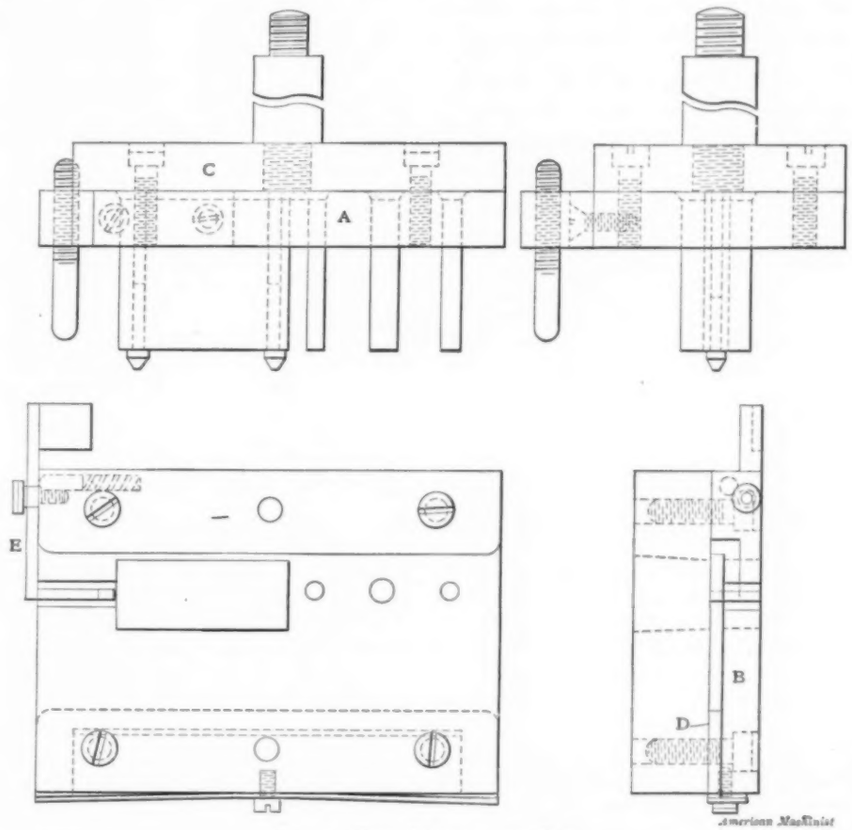



FIG. 1. THE PUNCH AND DIE

Fig. 1 is a sketch of the tools complete with the guide plate and finger feed fitted on the die and also shows the general arrangement of the punches and punch holder, with the trip for working the finger feed. Fig. 2 is a sketch of a special sleeve to be used in presses where the stroke is too long. In this class of tool the punch must never leave the guide plate and should be left in the plate as far as possible. It should come up far enough to strip the metal and no further, as the life of the tool is thus prolonged and the wear of the guide plate is cut down to a minimum.

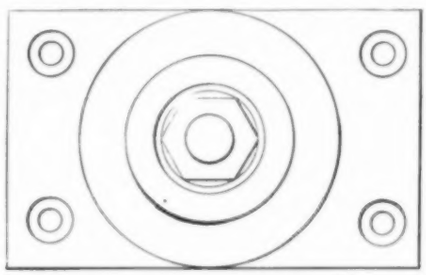
### MAKING THE PUNCH

In making these tools it is customary to make the punch first. Take a piece of cast steel and either lay out the shape or mark it out with the pattern, then machine it as near to the line as possible, taking great care that it is parallel, as it is necessary that when the punch enters into the guide plate it should fit all the way up. When the punch is finished it should, of course, be hardened and tempered. I have not mentioned the drilling of the holes for the pilot pins, but obviously they should be laid out and drilled before the hardening operation.

### THE PUNCH PLATE

Now that the punch is finished lay out the punch-holder plate *A*, care being taken in laying out in the exact position required. Before this is done all the plates should be machined all over so they will be flat and the edges square so that in laying out the holes when the parts are assembled they will prevent one part from overlapping the other. When the location for the punch is marked out, it should be drilled, cut through and filed close to the lines, leaving just enough metal for the punch to shear, which is done by using the press.

The punch must be kept square with the flat surface of the plate, as it is necessary that it should be in perfect alinement with the slide of the press, for it has to go through the guide plate *B*, a tight fit. The punch having sheared the plate, the upper end should be hammered over to keep it from drawing out, the top of the opening in the plate being beveled to suit. The punch is then forced home and the top finished off level with the plate. The plate *C* is then attached with the four screws and the hole in the center tapped for the shank. An ordinary shank is then screwed in temporarily to suit the bore of the press.



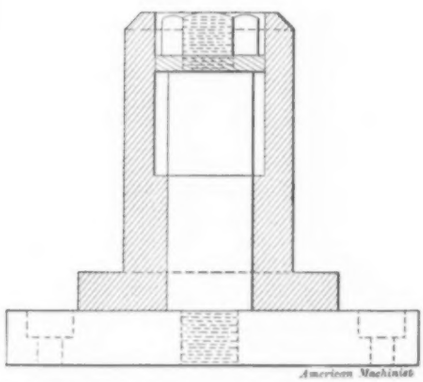



FIG. 2. THE OPERATING SLEEVE FOR THE PUNCH

### DIE AND GUIDE PLATE

The die and guide plate are assembled with the dowel-pin holes left out of the guide plate, as in hardening the die the holes are apt to alter and the screw holes

are sufficient for the time being. I should have mentioned that when the punch plate *A* is drilled for the punch it should be clamped on to the guide plate and used as a jig for drilling. Now, having the guide plate fixed in position on the die, the same process is repeated and the die is drilled out. The die should then be filed out as near to the lines as possible and then put in the press and sheared with the punch, the clearance given to the back leaving the top smaller so that the punch will shear its shape. The die is then taken out and the slight angle given to it leaving it nearly parallel as it can then be ground for some distance without losing the shape. All the other holes should now be drilled and the die can be hardened and tempered. Where there are irregular-shaped holes in the die, the others should be left out of the guide plate and top plate until the die is hardened.

### Assembling Die and Guide Plate

The die being finished, the guide plate is fixed on with the screws. The clearance holes must be large enough so that the screws do not crowd one against the other. Drill the two dowel holes and fit the pins in nicely and parallel; everything depends on the pins which keep the two parts in line, as they have to be taken off and they should go together exactly again. See that the punch enters the die after it is hardened; if a bit tight it must be eased until it enters properly.

### Finishing the Guide Plate

Set the die in the press and clamp it in position, then put on the guide plate and screw it in position, let the press down on to it, and with a scriber mark the outline of the punch on the plate; then take it off and file near to the line, leaving enough metal all around for the punch to shear. Now put it on the die again and shear in position. In this way the guide is brought into line with the die, and by polishing the guide plate with emery cloth, it is made a nice sliding fit, perfectly tight on all sides. The top plate with the shank can then be taken off and the round holes can be spotted with a center drill, which fits the holes in the die, then with a twist drill open the holes to a few thousandths smaller than finish size and finish with a rose reamer. This insures the holes being in line and exact to size. Countersink the holes in the top of the guide plate and the plate, now being finished, use it to transfer the holes in the top plate in the same manner. Form a rivet head on the round punches and drive them into position level with the top of the plate. Fit the pilot pins into the punch and harden the piercing punches; this completes the punches and die as far as the fitting is concerned. If all the parts are fitted nicely, they can be taken to pieces and put together again perfectly in line.

### The Stock Guide and Stop

The next thing to do is to slot the guide plate into the hole for the punch, about 5/16 inch wide, for the finger to work into, and plane a recess in the bottom of the plate wide enough for the brass strip (which is cut wide enough for two blanks to be punched out) and to take a strip *D*, about ¼ inch wide, which acts as a buffer to keep the sheet metal against the back part of the guide plates and allows the strip of stock to pass through freely, even if it should be cut a bit wide, as is often the case. The guide plate is cut across at each end for the plate *D* which is kept up by a flat spring which rests on either end.

The finger *E* is bent at right angles to engage the strip close to the punch, and is fitted with a screw, which acts as a pivot. Just behind this is a round pin with a small spiral spring, which keeps the end of the finger always forward. It is tripped by the adjustable pin fitted in a bracket on the top plate. When the press slide comes down the pin strikes on the end of the finger *E* (which is turned up to form a flat step), thus lifting it above the metal; when the press is on the up stroke, the finger comes down on the scrap between the blanks thus resting in such a position that when the metal is drawn along when stripped from the punch, the finger drops into the hole and forms a stop as the metal is fed against it.

This automatic stop has been used successfully at a speed of 200 strokes per minute on blanks no wider than ¼ inch; of course, the wider the blank, the better chance it has of not jumping over the gap.

The punch and die should be ground before the final setting, and the result will be a good clean blank with no chance of the tools shearing, even if they cut a half blank. The dowel pins should be put in fairly large, so that they will not spring, as the strain comes on these two or more pins. When the stock cut is rather heavy, it is advisable to clamp the die in the bolster as the punches are made longer than need be, for that purpose.

### The Operating Sleeve

The special sleeve is easily understood by the sketch, Fig. 2. In the top plate is screwed a plain stud threaded at either end. The plain body fits in the bush for the press slide. The bush is recessed for a distance equal to the difference between the stroke of the press and that required for the stripping of the tools, plus the nut and washer, so that as the press ram travels up and down, only a portion of its stroke is applied to the tool.

### Making Delicate Tools

On very delicate work where the punches are thin and will not hold up for shearing their way through steel they are fitted by filing and when the die is hardened and the guide plate has been fitted the punch is entered and forced through the guide plate far enough to enter the die, the parts then clamped together and the dowel pins fitted, which answers just as well but takes more time. On small work where there is not much chance of the die shrinking by any perceptible amount, the guide plate is made first and used as a templet for the die and punch plate. In this manner the tools can be made up fairly quick as it is a matter of the plate and die being fitted together again.

In all cases the punch is made first of all and hardened.

London, Eng. C. Petitjean.

## An Electric Micrometer

The criticism by George E. Gay, at page 513, of an electro micrometer described by me at page 1025, Volume 32, Part 2, has been of considerable interest to me and to others who have had quite an extensive experience with the tool in question. Mr. Gay has discovered some faults in the tool that as a matter of fact, do not exist, while the one drawback that has been found to be serious, particularly in measuring deep holes, viz., vibration of the needle bar, he does not mention.

It is impossible within permissible space to show or to describe every detail of construction or use of a tool of this character. For the benefit of those who may have read the original article, as well as the letter of Mr. Gay, I will state that the device was made not only for the particular purpose shown in Fig. 7 of my article, but for general use, and that the needle bar shown in the sketch referred to in connection with a grinding machine is only one of three different lengths that are used with the instrument, the shortest being 2 inches long. A little consideration of this statement will show that the gear ratio is not so entirely wrong as it might appear to be, but even with the long needle bar it is of no consequence whatever whether the thimble is rotated 0.025 or 0.00001 inch, for the sufficient reason that the reading is not taken (as Mr. Gay seems to think) with the contact 2 traveling toward the work, but when it is by a retrograde movement of the micrometer thimble caused to move away from the work being measured, and the buzzer has ceased to sound.

As the contact on the needle bar cannot be in electrical communication with the work at this time, the deflection mentioned by Mr. Gay cannot possibly exist; the only chance for such a condition is that due to the weight of the bar and changes in its shape due to such heat

as it may absorb from the work being operated on. In my opinion, if the electric current used with the device was derived from a dynamo electric machine such an arc would be formed at the moment the contact was broken as to make measurements of any kind impossible, but with the small current used, as I have described it, and with the buzzer magnets of the right resistance, no difficulty has been encountered in obtaining measurements uniform. It is not possible to estimate how far the electrical contact may be from the work, but from the experience I have had, I believe that actual mechanical contact (although exceedingly slight) exists after the buzzer ceases to sound. In an instrument constructed lately, I have used a small galvanometer instead of the buzzer and find it a considerable improvement.

I will further point out that if the diameter of the bore of the bushing shown in Fig. 7 is the same at both ends, the test for parallelism is precisely correct as described, and will reveal exactly as I have stated whether the hole is parallel or not. This can be easily proved by anyone having access to a universal grinding machine of the type commonly used in this country. For the purposes of the description, I assumed that the grinding of the bushing had proceeded nearly to a finish, and that before arriving at this point, the swivel table had been turned so that in at least one cut the hole had been found parallel, and of the same diameter at both ends. Men with practical experience with this class of grinding know, however, that during the process of grinding, the work, if hardened or soft, continually changes its shape, and a bushing as described, that has been made perfectly true, may in the course of a few hours or over night, be found elliptical or imperfect in many other respects, and I have found holes that had been made of the same diameter at both ends after standing a short time to be larger at one end than the other, no matter how carefully the work was done, but it must not be assumed that because I found the bushing with one end larger than the other I shifted the swivel table that had once made the hole correct *before I made the measurement*. Ascertaining the diameter of the two ends of the hole is an entirely different matter than finding if elliptical, and is one reason why I use the line *H* as shown in Fig. 1. As actually made, the contact 2 is 0.125 inch long and projects equally from the two sides of the needle bar. To ascertain the diameter of the hole, a surface gage on the swivel table brought to the line *H* and the point of the needle bar enables a proper setting of the tool. The contact then being brought approximately to the center of the hole, by rotating the thimble of the micrometer, the needle is swung from side to side, and readings taken. These added to 0.125 (length of contact) give the diameter of the hole.

I wish to say in conclusion, from an experience extending over a year with this instrument, as used by myself and others, that if applied with understanding, it has merits that will keep it in use until something better than the spring indicator (which, by the way, is not above criticism) can be found.

GEORGE J. MURDOCK.

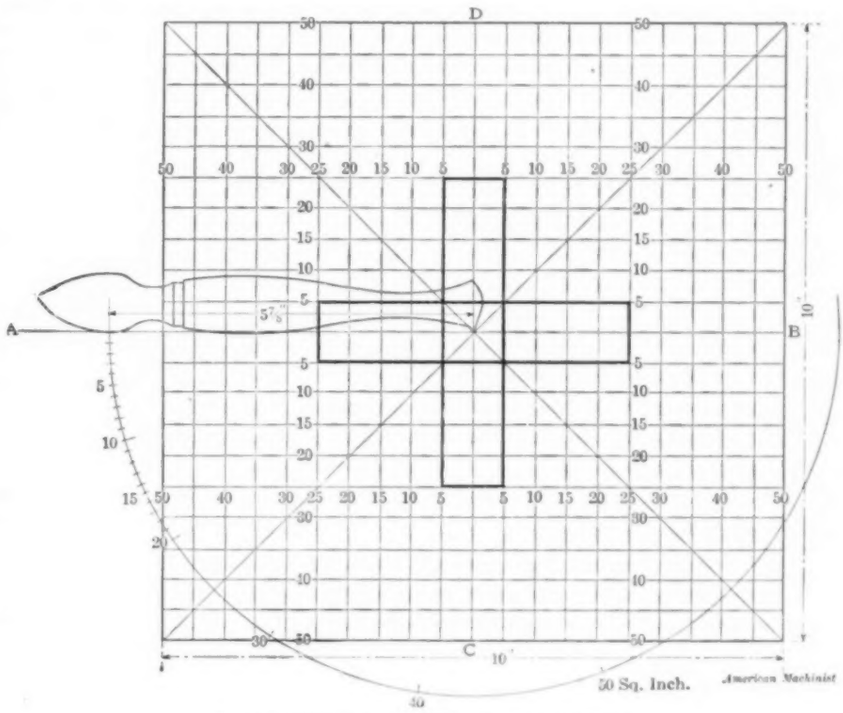
Newark, N. J.

## A Calibrated Hatchet Planimeter

Accompanying diagram refers to H. R. Edgecomb's article The Hatchet Planimeter, Vol. 33, Page 20, wherein it is said that any knife with a suitably attached pointer will serve as a planimeter. This gave me the idea of making such an instrument of my eraser knife, as shown in the cut, by carving the tail of its handle in such a way that it can be used as a pointer while it is held lightly between thumb and forefinger. The length of its beam is 5⅞ inches. With this measure as radius I drew an arc whereon I made marks obtained by pointing round the perimeters of the quadrangles with known area, starting in all cases from the same central point and in the same direction. The figures 5, 10, 15, 20, etc., in the interior of the diagram are the corners of said quadrangles having an area of 5, 10, 15, etc., square inches, and for eliminating errors as much as possible, I chose for every division on the arc representing an area two equal quadrangles, with coinciding centers, one with vertical and the other with horizontal position.

If, for instance, the area of an indicator diagram has to be measured, intersecting lines must be drawn through its approximate center of gravity, and after the latter is brought over the center of the circle of the chart the pointing can be performed in the usual way. The eraser blade indicates the area of the diagram directly from the circle within 1 per cent. of error, if the pointing is done properly.

The advantage of this chart lies in the fact that no corrections are necessary. The division of the scale shows that, under the given circumstances, a nearly constant coefficient of correction could be found for areas up to 20 square inches for obtaining the area by multiplying the length of beam by the distance of the mark from the starting point. From there the division proceeds as a kind of progression.




CALIBRATION OF A HATCHET PLANIMETER

After the division on the arc is once ascertained only the so obtained scale and the two center lines *A B* and *C D* are required for measuring areas of 50 square inches and more.

The cut is not to scale, but dimensions are given so that anyone may see how to construct another one to suit the length of the knife used.

Winterthur, Germany. SACHS.

In casting the main piece of the stern frame of the mammoth steamship "Olympic," now under construction, about 95 tons of molten metal were required.

## Concrete Floors

I have been reading with considerable surprise your discussion on the subject of "Concrete Floors for Machine Shops and Factory Buildings."

The principal objection to such floors from the view point of the men who must work on and walk over these floors has not been mentioned at all. The various discomforts and inconveniences are a very small matter compared to the direct dollars and cents loss which they cause. It is no exaggeration to say that the expense of every man who works in a machine shop with a concrete floor is increased from one dollar to two dollars per month in keeping his shoes in repair. It can readily be understood that a tax of this amount from the earnings of the operator makes a relatively large item. This is so well understood by some large corporations, that although they build machine shops with concrete floors and an elaborate system of ditches and drains to carry off cutting compounds they at the same time cover this cement with a substantial wood flooring.

That a fact so well known and so frequently commented upon as this should escape notice in your columns is the reason of this communication.

Ossining, N. Y. A. L. PUTNAM.

## A Collection of Comments

I was glad to see some comments on our old friends, the flat drills, in Mr. Bocorselski's article. When I was a boy, we used to hammer these things out of flat stock, and sometimes we twisted them and sometimes we got caught and they twisted themselves, backward. What I want to say, though, is that the twist drill milled from the solid would never have had the vogue it did if it had not been for the taper shank. We used to leave these shanks rough and put them in . socket held by a set screw. If the point ran out, which it always did, we banged it over with a monkey wrench, then no other part ran true, so we got a taper hole, unless we had ground the thing off center to make it cut large. I made up a set years ago with turned bodies and shanks and put them in alongside the milled drills and they were pretty well liked around the shop.

What would we have thought 20 years ago of using up 25 horsepower running a single drill? That ran a good-sized machine shop then. Some day we will begin to sit up and look after the power plant of the machine-tool business. It is getting to be an important matter and a visible item in shop expenses. I think that in the majority of shops—tool shops—they simply buy an engine and a boiler and hire an engineer and get in a load or two of slate with a little coal adhering to it and let 'er go from one year's end to another. If she blows steam straight through the cylinder they never know the difference. That is getting to be a thing of the past, and indicators and all the steam-saving devices are beginning to be looked up.

### EMPLOYERS' LIABILITY

Talking about employers' liability, that is quite a step that Mr. Parker has taken. The scheme in general vogue is, of course, all wrong, though most employers appear to use it. I ran a shop for 10 years without a cent of insurance and never paid a cent of damages. Of course, if a man was hurt I took him home and I went around to see him as often as was necessary and paid the doctors' bills. Then I always set him to work at something if it was only counting the cracks in the floor as soon as he could get out. Human nature is about the same as usual, and men never, or almost never, fail to respond to decent treatment unless they get stampeded in a mob. The best way to handle this thing is to pay your men money enough so that their job is worth more to them than the few dollars that a claim lawyer will let them have after they are through the job.

Mr. Campbell falls into the old, old error on page 495 of thinking that where power is transmitted by friction there must be some slip; that is, that friction must produce motion or it is not friction. If he will take two blocks of wood and lay one on top of the other on the table and draw the lower one along he will find that he can pull back on the upper one quite a bit without its slipping a hair. Of course, so long as we use elastic belts we will get creep, but that is another story.

### CONCRETE FLOORS

Concrete floors are cold; especially on the ground floor. It can be helped a lot by putting down a carpet. Sheet rubber is just as good. If sheet rubber is too expensive and the boss must lay it all over the floor, cut out a sheet the size of each foot and stand on that. So as not to bother you, glue it on. You can buy O'Sullivan's or any other kind you want. Of course, this scheme is not so good as covering the floor when you are going to drop tools. Better do up each tool, before you drop it, in cotton waste. Or, better still, not drop it at all—just as you please about that, though. Some folks never drop anything—not even money. Others drop everything. They ought to get jobs in foundries, or where they make feather beds. The rubber heels are good for headaches, too, for the same reason they are good for backaches and leg aches and toe aches. You see, when you get too tired, you show it in the weakest spot—hence the [illegible] aches.

By the way, I heard Elbert Hubbard the other night. He says the only people who think of heaven as a place of no work where every day is Sunday, are those who are overworked. I have no doubt of it. I get to thinking about it every once in a while, and think I would like to go there, but when I do I shall want to take along a drawing board and a pad of paper and pen and ink. Of course, I would not work. Oh, no! But there are a number of little problems I would like to sit down and work out when I could have plenty of time. Mrs. Entropy says she will pack in a few sheets of asbestos board and a slate pencil so that I will be surely provided.

Springfield, Mass. ENTROPY.

## Financial Mechanics of Aviation

Exception has been taken by one of our correspondents to our footnote to a letter under the above heading, appearing on page 559, in that he says the propeller would have too high an efficiency as we have figured.

Our statement was that the 23 horsepower calculated by J. A. Footwick as that developed in sustension and flight of the aëroplane is that actually delivered by the 35-horsepower engine. If the full 35 brake horsepower were delivered to the propeller and 23 horsepower were actually usefully delivered by the propeller in moving the aëroplane, the efficiency of propulsion would be 65.7 per cent. The efficiency for ship propellers according to good authority, varies from 60 per cent. to something less than 80 per cent. Some very eminent aëroplane builders and operators claim at least as good results with their present air propellers.

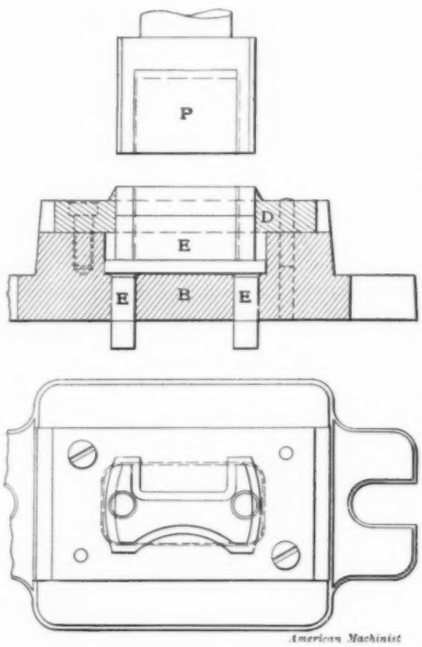
As a matter of fact, the original assumption was that the nominally rated 35-horsepower engine was delivering only 30 horsepower. If all of this reached the propeller, and the latter delivered 23 horsepower in useful propulsion, the efficiency would be 76.7 per cent. which probably is absurdly high. This assumed output of the engine was temporarily lost sight of in the calculation.

Our further reference to the "theoretical" power required to sustain the aëroplane meant that power which would be required to do this if our machinery, and especially the propeller, were perfect, and there were no losses. We know of no way to figure that, although several methods have been proposed in our pages; some obviously wrong and others of doubtful value.

We did not agree with the "falling body" mathematics which have been so severely criticized, but it was the purpose of publication in that case to create discussion.—ED.

## Punching Fiber

At page 915, Volume 32, Part 2, Mark Dale relates his experience in cutting red fiber in the punch press, and in conclusion he solicits further information from your readers. Ordinary press tools, as used for cutting metals were tried, and experiments led to the construction of tools which possess some of the characteristics of leather-cutting tools known as "dinking dies." Dinking dies, however, have such thin knife edges that it would be impossible for them to withstand the cutting of red fiber if it were not very moist. Ordinary press tools tear the fiber apart rather than cut it, and the edges of the blank present a very ragged appearance. What has solved the difficulty in the case of certain small circular blanks may solve Mr. Dale's trouble too.




PRESS TOOLS FOR PUNCHING FIBER

Briefly the solution may be stated thus: use the fiber in a moist condition, cut it, and compress it in the die.

To do this he will need tools constructed as shown in the sketch herewith. Inspection will show that the punch *P* is made as though for cutting metal, only that its parallel part is of somewhat greater length than usual. The die *D* is made much the same as his, only the inside is parallel right through, and is fitted with an extractor *E*. This extractor has a foot on it as shown by the dotted lines in the plan; the bolster *B* is recessed to take this foot, and is also drilled for the two extractor pins *E E*.

In operation the blank is cut out as usual, but, instead of falling through the bed of the press, the punch is so set that it compresses the blank, in the die, between itself and the extractor. On the return stroke the extractor rises, pushing the blank out of the die, and it is then brushed aside by the operator.

The following points may be noted: The extractor must be of the positive type, the die must be of ample proportions to allow of the fiber being compressed without fear of bursting the die, and the fiber will need to be thicker than the finished blank to allow of compression. Compression must take place below the chamfered part of the die. Attention to these points will doubtless result in a blank whose edges are not rough and uneven, but smooth and shining, and it will need but one operation.

London, Eng. W. L. WOLF.

## The Narrow Guide in Machine Tools

Fred Horner, in his article on the above subject, at page 346, appears to have subordinated the main feature which should obtain in all machine tools, viz., the correct location of the propelling force for any particular function of the tool, to that of the narrow guides which he thinks so advantageous. Early in the article appears the statement that many advantages are obtained, due to the great preponderance of length to width of bearing, and incidentally mentions later that with the arrangement shown in the case of the lathe, the guiding surface is nearer to the screw, which is an advantage. Now, to my mind, the idea expressed by this latter remark is much more important than the former question of long guiding surfaces.

Mr. Horner's T-square illustration seems rather badly chosen and bears little or no relation to the subject, for it would be absurd to attempt moving the square by the outer edge of the blade, and much more so to apply the same principle to a machine tool. Neither is it necessary in this connection to have a long guiding head as there are in use at the present time many parallels applied to drawing boards where the guiding surfaces are extremely short and placed one at each side of the board, with a long blade intervening, and still there is no difficulty in moving them if the force is only applied in the right place. The whole crux of the matter would seem to lie in this point, and any bad design in this respect would be equally noticeable whether the guiding surfaces were long or short.

That these long guides are being adopted by some makers is no criterion that they are best or even necessary as a great deal of machine-tool design at the present time appears to be dictated by fashion rather than from a point of practical utility, and I believe this is a case in point, for I have nowhere seen it demonstrated or proved, although it has been stated repeatedly, that excessive length to width is any better than the ordinary moderate proportions which have been in use and proved satisfactory for so long a time. The question undoubtedly appears rather one of correct location of the propelling force than of guiding length proportions, for I know of many cases in actual practice where the guides are comparatively short, but ease of action and manipulation is still maintained by a carefully studied application of the moving force.

In confirmation of this view, I cannot do better than refer to Professor Nicolson's book on lathe design, "Lathe Design for High and Low Speed Steels," by Nicolson & Smith. Dealing with this same subject, he shows that the proportion of length to breadth has nothing to do with the question, which is one of length only and provided this is sufficient at the outset, nothing can be gained by increasing it. Again, discussing the question of driving force, he shows that if there is any gain at all with the long guides, it is so little as to be practically negligible and does not warrant the additional work and expense entailed while there are many objections attendant upon the new arrangement which put it at a discount.

The only objection that can be raised against the old method of the broad guide is the tendency to spring the shears of the bed or slide should the adjusting strips be screwed up too tight, but this need not occur with a properly designed section of box form, several of which are in use at the present time. To use the Professor's own words, all things considered, the advantages of the narrow guide type compared with a properly designed and proportioned section of the other type may be seriously called in question, and indeed, the balance of advantage, whether for economy, accuracy or durability, will be found by the impartial investigator to be entirely against the long, narrow form.

Manchester, Eng. C. H. HILL.

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In a bulletin of the Bureau of Standards there appears a paper dealing with the luminous efficiency of the firefly. From this paper it is noted that the equivalent efficiency of the firefly as a light producer seems to be in the vicinity of 0.02 watt per candle, while the highest figure reached by any known artificial illuminent is in the neighborhood of five or six times this quantity. In commenting on this interesting topic the *Engineering Record* states: Of course one cannot say what the equivalent of the firefly's light may be in vital energy in the insect. There may be large waste in the physiological processes involved, but it is certainly true that the firefly has the engineer "beaten to a frazzle" in the matter of sheer physical efficiency of light production.

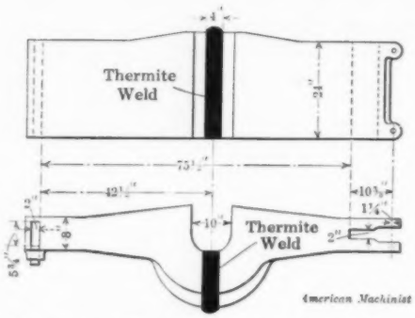
# Several Neat Locomotive Repair Jobs

*By J. P. Matthews*

We have had trouble with our cylinders breaking under the valve chamber, sometimes the crack would be about 8 or 10 inches. I find that by lacing the crack with stay-bolt iron, then calking in good shape, you save the great expense of a cylinder. We have three engines running that have been laced up in this manner from three to six years and not a sign of leak to be seen. These cylinders are the piston-valve type. The crack was caused by expansion.

### Loose Main Driving Wheel

We had an engine with a loose wheel about five months ago in the roundhouse and the foreman, F. H. Wheeler, put a row of tapered pins around the journal 1 inch by 9 inches long, drove them in with a ram hung from the roof, using eight men. This engine stayed in service five months then came in the back shop through my gang. I had this put in press and put 200-tons pressure on it, but could not move the wheel. The engine is now back on the road doing good work.




Repairing Resistance Post for Hydraulic Press

### Fitting Driving Boxes

On locomotive driving boxes with grease cells, first cut away about 1 inch on both sides of brass, not over 1/32 inch deep, so grease will go around the journal. This I find after nine years' experience gives the best result. File fit the brass 1/64 inch larger than the journal; in putting up, put valve oil on journal and a thin skim of grease on perforated plate, that will make your grease start to feed before the engine gets to roundhouse. By following this rule you will find that it not only stops hot boxes, but you will never have the boxes knock. Do not cut groove in your brass as this causes grease to pack in them, causing a hard burned substance, which is injurious to journals. Do not scrape brass. One trial will prove this practice gives the best results.

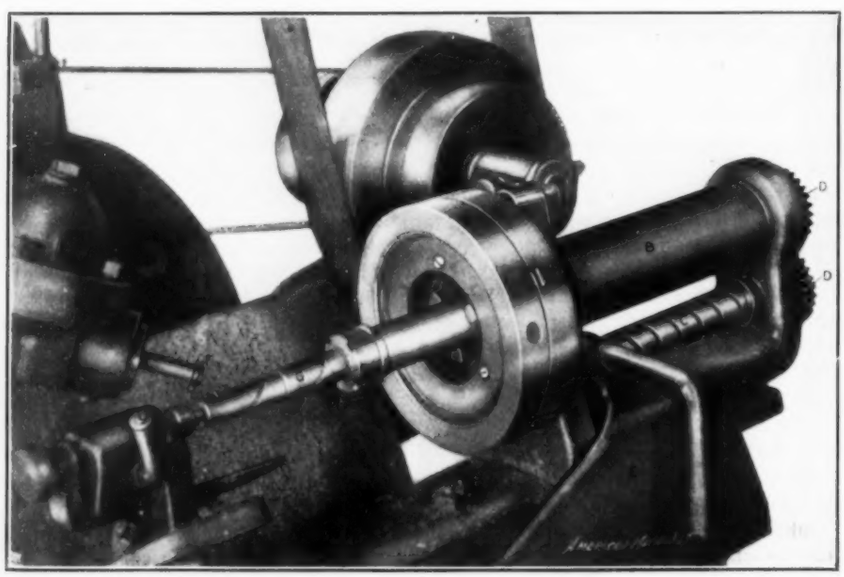
### Subwheel Press

Several months ago our wheel press broke the stop casting in half and we were in a tight place, as we were behind on our work. So the general foreman thought he would try to weld it with "thermit." He made his plans although every one told him it would be money wasted. The sketch shows the weld which has now been in use four months and has stood 200-tons pressure. The press has given good results and will for a long time. The press was only out of commission two days and four hours. This shows what can be done with "thermit."

# Cutting Spiral Oil Grooves in Spindles

*By E. A. Dixie*

The halftone shows a very neat arrangement of a Whitney hand miller for spiral milling. Mounted on the bed is a fixture *A* which has a spindle *B* to which a universal chuck is attached. Below the spindle and parallel to it is a steep-pitch screw *C* which is geared to the spindle by the gears shown at *D*. The nut for this steep-pitch screw is carried on a bracket *E* secured to the knee of the miller. Obviously as the table is moved by hand the stationary nut will cause the screw to rotate and it in turn will actuate the spindle through the gears, and the work *G* held in the chuck will move in a spiral past the cutter *F*. The miller is equipped with one of those handy little universal milling heads built by Porter & Cable, of Syracuse. The machine makes a good job and does it rapidly. The direction of the twist of the spiral is such that the oil is made to flow from the oil hole to where it will do the most good when the shaft is in use in an automobile transmission. The device shown is in the shops of the Brown-Lipe Gear Company, Syracuse, N. Y.




Cutting Spirals on a Plain Hand Miller

A report on the relation of industrial training to the general system of education submitted to the president by the national Society for the Promotion of Industrial Education lays stress upon the need for a comprehensive and thoroughgoing statistical investigation with reference to the following points: (1) The needs of the different States and localities for skilled persons in the trades; (2) the character of the curricula and the service of existing industrial and apprentice schools in the United States; (3) the relation of existing industrial schools to the general educational system of their State and of their region; (4) the lessons to be learned from industrial schools in foreign countries. The report recommends that the above investigation be intrusted to the United States Department of Education and that the financial support necessary be furnished by Congress.

A correspondent calls attention to the fact that a little graphite in the oil used on lathe centers materially aids in obtaining proper lubrication.

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American Machinist

# Editorial

## Apprentices May Be Had

The reiterated complaint that there are no boys who want to learn trades is without foundation. We pointed this out in an editorial on page 38, and after referring to several instances where experience shows that boys could be obtained we expressed this opinion: "Some may object that these experiences are not yet sufficient, either in number or age, to justify an absolute conclusion, but they are undeniably sufficient to justify a strong opinion that the combination of good teaching with an opportunity to earn at least partial self support, will solve the problem of getting apprentices."

Investigations carried on since that was written have shown in every case that boys are ready and willing to avail themselves of trade training and, in fact, are waiting for the chance. If the boy believes he is to have a square deal in learning the trade he is eager.

In the former editorial we referred to the experience of the General Electric Company, the Trade School in Fitchburg, Mass., and Professor Sweet's Artisan School at Syracuse, N. Y. All of these attract boys. All have deliberately provided for teaching the things that a mechanic should know in order to be master of his trade.

Additional testimony is now before us from the Bridgeport Trade School carried on in coöperation with the local Y. M. C. A.; The Independent Trade School of Worcester, that was opened about the first of March; the Industrial School at Beverly, a case of real coöperation between the management of a large machine shop and the school authorities; the apprenticeship system of the Westinghouse Electric and Manufacturing Company, of Pittsburg, Penn.; the apprenticeship system of the Fore River Shipbuilding Company, Quincy, Mass., and the Williamson Free School of Mechanical Trade, at Williamson, Penn. All of these institutions have a waiting list. The Beverly School accommodates 50 boys, and has a constant waiting list of some 15 or 20—this in a small city of only 17,000 inhabitants. The Fore River Shipbuilding Company has 149 apprentices enrolled and a waiting list of some 300. The Williamson School enters 70 or 80 boys each year, and these are selected from a list of some 400. The last institution, however, does not parallel the others, for it is richly endowed and boards and cares for the boys as well as instructs them.

This is cumulative evidence of the strongest kind, and we believe that we are perfectly justified in stating that complaints of a lack of apprentices or boys wishing to learn trades are not founded on fact. Prepare for adequate training of the boys and the boys will come forward eagerly to avail themselves of the opportunity.

## Wanted: a Book of Machine Design Standards

It is a perennial matter of complaint among shop men that the graduates of our technical schools who go into the drawing office are unable at first to produce even a simple design which has a "mechanical" appearance. They may be capable of figuring out complicated stress problems and of correctly estimating the necessary resisting sections; they may be able to make neat and accurate drawings, but somehow their work always has an amateurish look which betrays it at once to the experienced eye.

This condition is very generally recognized in the schools themselves, and, in an effort to remedy it, many of them make a special point of employing only men of considerable practical shop experience as instructors. Even then the results are not much improved when the student gets away from the watchful eye of the instructor and is thrown on his own resources.

He simply has not been around machinery long enough to know how it ought to look, and this, together with his untrained habits of observation, make him utterly oblivious to the glaring absurdities of form and proportion which are often exhibited in his drawings.

Many of what, for want of a better term, might be called "standard" forms of machine parts are the results of a long process of evolution in which the question of stress has played but a minor part. The experienced man will adopt these forms instinctively, though he may not always be able to give a clear reason for so doing. He knows that they

"look right," and if he has had enough experience, his judgment will be confirmed by the results.

This intuitive feeling for form and proportion is something which the schools themselves will probably never be able to impart, and yet it seems to us that there is the possibility of a considerable improvement in this direction.

The machine-design text books in use today are, with few exceptions, mainly devoted to the stress-strain and kinematic features of the subject. They are invaluable aids to the designer, especially if he has to depart much from the beaten track, but they are by no means the only requisite, and the raw student who relies entirely upon them will quickly find himself confronted with difficulties for which they offer no solution.

Our suggestion is that an addition might be made to the existing texts, possibly in the form of a companion volume, which should aim to supply, in a measure at least, the lacking element of experience in a sort of "predigested" form.

It would consist largely of illustrations of machine parts and tables of dimensions taken from the best modern practice, and the whole tied together by a running commentary in the text. This commentary would explain as far as possible the conditions which have governed the development of these forms, and among the questions discussed would be the influence of such factors as shop methods, economy of production, ease of operation, accessibility for examination, etc.

The chief difficulty about such a book, after finding the man who could write it, would undoubtedly be that of keeping it uptodate, since so much of our machinery is in a transition state. Designs which are standard today may become obsolete almost over night, and this is doubtless one reason why so little has heretofore been done in this direction.

Nevertheless it would seem to be possible to fill a fair-sized book with descriptions of machine parts which are "standard" in the sense of their having now such a stability of form that we may reasonably expect it to continue for some time to come.

We have recently had expressions of opinion on this subject from a number of well known teachers of machine design. They are in close accord with the views expressed here as to the desirability of such a text, and there seems to be little doubt that it would be warmly welcomed by the teaching fraternity in general. It should also be a useful addition to the library of the experienced man, for if properly written, it may not only give him reasons which he has perhaps imperfectly understood for many things which he is in the habit of doing, but may also help to indicate the lines along which future developments may be expected to take place.

## Convention of the National Association of Manufacturers

The forthcoming convention of the association to be held at the Waldorf-Astoria, May 16. 17 and 18, promises to be one of the most important annual meetings that has ever been held. Two subjects are to be the principal features namely, "Prevention of Industrial Accidents" and "Employers' Liability Insurance."

During the past few months a special committee has been at work preparing a report on these subjects. It has communicated with 25,000 employers in all parts of the United States, as well as with 250 National, State and local organizations of employers. Every State legislator in the United States has been written to. Special correspondence has been carried on with American and European experts, with State commissions, and officers of societies and organizations interested in the subject. Something over 10,000 replies have been received, and these disclose a wonderful source of information. Among all this great number of letters only three have protested, even in a mild manner. The correspondence has disclosed that 99 per cent. of the membership of the National Association of Manufacturers favors a constructive, progressive policy for dealing with these questions. It is intended to devote one-third of the entire time of the convention, that is the second day, to these important subjects, and a number of prominent men are expected to speak.

## Machine Tool Builders' Convention

The forthcoming semi-annual convention of the National Machine Tool Builders Association, to be held at the Hotel Seneca, Rochester, N. Y., Tuesday and Wednesday, May 24 and 25, will be one of unusual interest to machine-tool builders.

There will be an extremely interesting program, including an illustrated address on "Cincinnati Continuation School," by Prof. F. B. Dyer; "The Future of the Automobile Business with Reference to Machine Tools," by Robt. Pierpont, works manager of the Olds Motor Company; "Direct Advertising," by E. H. Hitchcock, versus "Trade Paper Advertising," by John A. Hill, and other subjects of particular importance, such as "Cancellation of Orders," "Cone Drives" versus "Gear Drives," by well known manufacturers in the Association.

## OBITUARY

John H. Converse, president of the Baldwin Locomotive works, financier and philanthropist, died at his home in Rosemont, Penn., on May 3.

Mr. Converse was born in Burlington, Vt., in 1840, and on completing a course in the University of Vermont in 1861, he took up journalism, in which field he remained about three years. He then entered railroad work and secured a position with the Pennsylvania Railroad Company, under Edward H. Williams, who at that time was general superintendent of the road. In 1870 he went with the Baldwin Locomotive Company at the instance of Mr. Williams, who had become largely interested in that company, and after a few years of notable service, he was made a member of the firm.

General management of company's business soon became Mr. Converse's duty, and under his guidance the works showed remarkable expansion.

Aside from his holdings in the locomotive company, Mr. Converse was interested financially in many other institutions and his benefactions to charitable and philanthropic purposes won him a distinguished position.

## PERSONALS

*Items For This Column Are Solicited*

Henry A. Owen, who has been a draftsman for the Whitin Machine Works, Whitinsville, Mass., for the past 20 years, has accepted the position of superintendent of the Dean Pump Works, Holyoke, Mass.

D. A. Heikel, connected with the main works of the Nordberg Manufacturing Company at Milwaukee, Wis., has recently been appointed manager of the Pittsburg office of that concern, with headquarters in the Oliver building.

J. A. McColl, of the engineering department of the American Blower Company, severs his connection with that company in order to become a member of the new firm of Ammerman, McColl & Anderson, Detroit, Mich., which will conduct a consulting engineer's practice.

The Massachusetts Institute of Technology makes announcement that this year will occur at the institute the first conferring of the degree of doctor of engineering in course. The institute has heretofore given a good many second degrees for advanced study in engineering, and a few degrees of doctor of philosophy to students who have pursued advanced study in chemistry and other more general sciences, but it has not heretofore conferred a doctor's degree on a student for extended advanced study of engineering.

# New Tools and Machine Shop Appliances

**Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost**

## The New "American" Full Universal Radial

The illustrations show a newly designed radial drilling machine brought out to meet all the requirements of modern drilling and to drive any drill made to its limit of endurance. The massive design of the arm can be seen in Fig. 2. This consists of an upper and a lower tube connected at the back by a double wall of metal and further strengthened by heavy transverse ribbing. The arm is clamped by two binder levers, has a coarse-pitch, double-thread screw for rapid raising and lowering, conveniently controlled and yet guarded against accidental movement. The arm is graduated in degrees for convenient setting.

*ANY new or improved machine or shop appliance of interest to our readers will be illustrated and described in this department.*

*A full and more detailed description will be given—when of special interest and it appears here before being sent elsewhere.*

*ALL descriptions appear in all four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.*

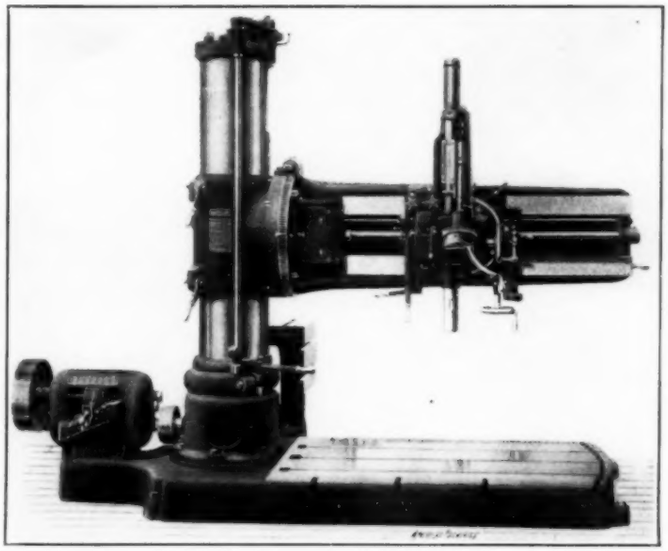


FIG. 1. TRIPLE-GEARED FULL UNIVERSAL RADIAL DRILL WITH 6-FOOT ARM

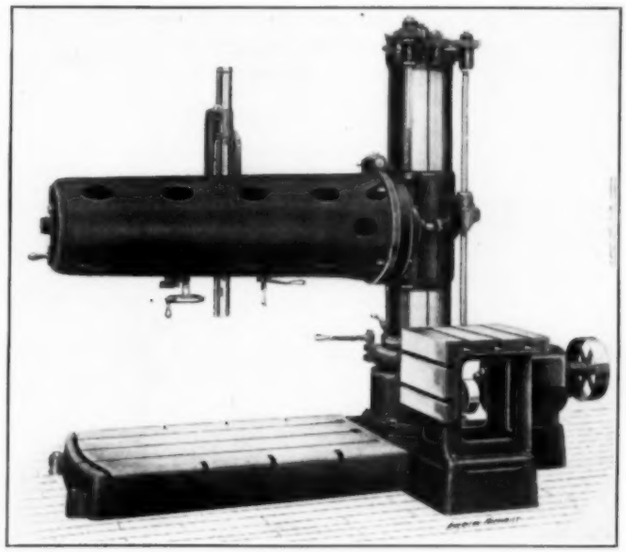


FIG. 2. REAR VIEW SHOWING MASSIVE DOUBLE WALLED ARM

The head is triple geared with all steel gears and, like the arm, may be swiveled through a complete circle. This is controlled by a handwheel through the gear-driven worm shown. The same wheel controls the rapid hand movement along the arm by throwing the clutch shown.

Power is transmitted from the saddle shaft, through miter gears to a shaft in the front of the head which drives the spindle by spur gearing. This saddle shaft is offset to one side of the spindle and mounted in two long bearings, one integral with the saddle, the other with the swiveling head. This avoids cramping and consequent loss of power with its attendant wear. There are 24 changes of speed with speed box, cone pulley or double friction countershaft as may be desired. These advance geometrically from 19 to 314 revolutions per minute and require but the handling of two levers. A speed plate on the arm girdle shows how the correct speeds are obtained.

The triple gearing provides one direct- and two reduced speeds, conveniently operated by a single lever without stopping the machine. By mounting these gears on the back of the saddle, fully inclosed by the upper walls of the arm, the complete rotation of the arm is secured without any overhanging mechanism interfering with the work being machined.

The feeding mechanism is located on the head and gives eight positive feeds from 0.006 to 0.060 inch per revolution of spindle. This is controlled by the two star knobs, the feeds being plainly indicated and any feed is instantly secured by turning the dial till the desired number comes opposite the fixed pointer. The feed train is controlled at the worm wheel through a friction and lever, which also controls the quick handling of the spindle.

The depth gage is new and as easy to read as a machinist's scale. The automatic stop is designed to trip at any point by setting the trip dog so that the scale reads the depth to be drilled, from

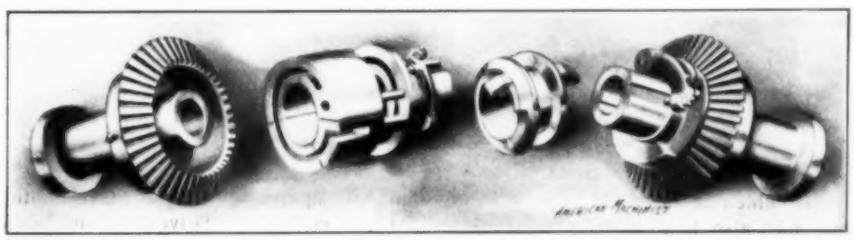


FIG. 3. THE FRICTION CLUTCH

zero. The trip acts automatically at the full travel of the spindle to prevent damage to any of the mechanism.

The tapping mechanism is mounted on the girdle end of the arm. This gives more room for ample proportion of parts and reduces the weight of the saddle. This tapping mechanism operates through the patented double band friction clutches shown in Fig. 3. These consist of an internal and external expanding friction all in one and is almost as positive as a jaw clutch. Owing to the location of these frictions they receive the benefit of the triple gearing which allows an 8-inch pipe tap to be driven by a radial with a 6-foot arm.

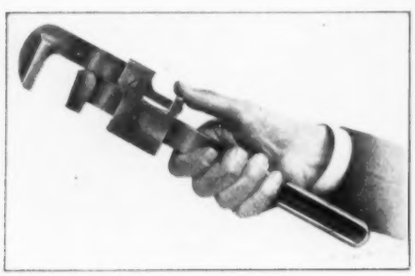
The column is double tubular, revolving on hardened and ground conical rollers. The clamping ring binds the outer column to the inner column or stump.

The speed box gives 8 changes by gearing of the core and tumbler type, any speed being instantly available. The gears are 20 degrees involute with pointed teeth, these having been selected as best for broadside engagement. There is an auxiliary train of gearing, controlled by a friction that engages when the tumbler lever is lifted and rotates the cone gears while changing speeds to avoid shock. A cushion is also provided between the speed box and the column to insure quietness and long life to the driving mechanism.

Bearings and lubrication have received careful attention, renewable bronze bushings being used throughout. Plain or universal tables are supplied and either motor or belt drives may be had as desired. These machines are built with 4-, 5-, 6- and 7-foot arms by the American Tool Works Company, Cincinnati, Ohio.

## The Wright Pipe Wrench

Our readers will remember the Wright monkey wrench which was first illustrated about two years ago, and will recognize the newest addition to the Wright family in the pipe wrench which is illustrated herewith. Its construction and operation are nearly identical with the other and require no detailed description. It is made by J. F. Wright, Canton, Ohio.



WRIGHT PIPE WRENCH

## A Relieving Attachment

Fig. 1 shows a front view of the new relieving attachment built by the Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, applied to one of their patent head lathes. With this attachment, either straight or taper work, with any number of flutes from 3 to 16 inclusive, may be relieved, and it can be furnished with their 14-, 16-, 18- and 20-inch lathes.

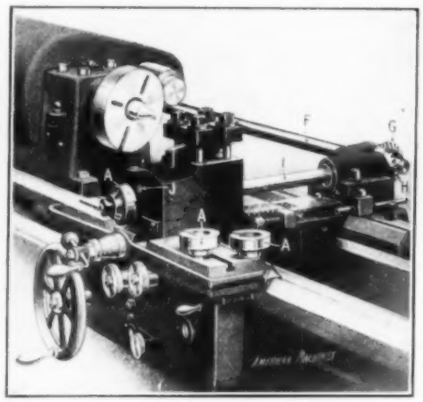


FIG. 1. FRONT VIEW OF RELIEVING ATTACHMENT

A special relieving rest is furnished with this attachment. If a compound rest is desired for turning, it may be substituted for the relieving rest, but the compound rest cannot be used with the relieving attachment.

Referring to Fig. 2, the gear *B* transmits motion through the gears *C* and *E*, mounted on the bracket *D* to the straight splined shaft *F*, which drives the shaft *I* through the miter gears *G*, *H*.

The bracket carrying the pair of bevel gears is fixed in position at the back of the carriage so as always to be in alinement with the change gear bracket at the headstock. The bevel gears are telescoped by their respective shafts, thus allowing free longitudinal movement of the carriage and free cross travel of the tool block.

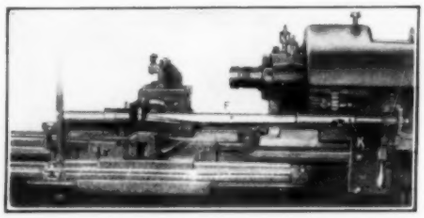


FIG. 3. ATTACHMENT RIGGED FOR RELIEVING SPIRAL CUTTERS

This construction of mounting the bracket directly on the carriage has several marked advantages. It is entirely independent of the taper bar, so that if the work to be relieved is not tapered the taper attachment need not necessarily be ordered. The carriage gives a more rigid support to the bracket than any taper bar could give. The universal coupling and any spring or give it might have is entirely eliminated.

Mounted on the front end of the shaft *I*, Figs. 1 and 2, is the cam *A*, Fig. 1, which bears on the roller *J*, mounted on the tool slide, and reciprocates it and the slide.

Three cams are furnished to give varying depths of relief, namely 1/32, 1/16 and ⅛ inch. Cams may be made by the purchaser to give other throws, if desired.

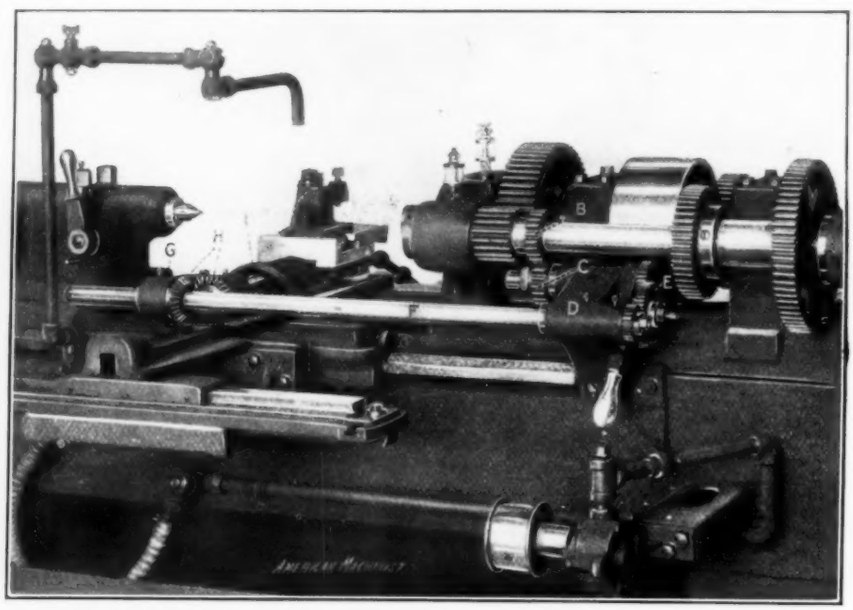


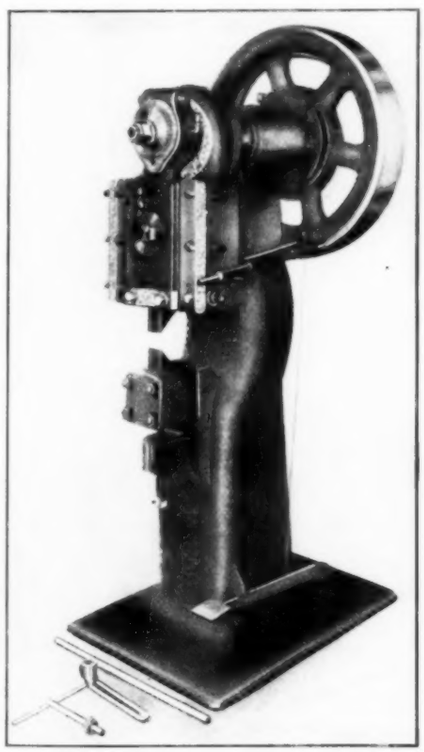
FIG. 2. REAR VIEW OF RELIEVING ATTACHMENT FITTED TO 16-INCH PATENT HEAD LATHE

All cams are single-throw cams. Multiple cams are not required, as the indexing to relieve different numbers of flutes, is all accomplished by the change gears. Exact indexing is always obtained by the single cam, since the spacing for the flutes in relieving various pieces is governed solely by the change gears *E*, Fig. 2.

Fig. 3 shows the attachment with a shaft *F* having a spiral spline for relieving spiral cutters. The socket *K* permits shafts *F* either straight or spiral to be interchanged.

## A Sprue Cutter

The halftone shows a new sprue press which has several new features. It is a modification of a power punch press designed to meet the needs of brass founders and other manufacturers of soft metal castings. It is furnished with both treadle and hand-lever trips. The use of the treadle leaves both hands free to hold and guide the work, the cutters



A Sprue Cutter

starting automatically at the highest part of the stroke. The overhung construction of the frame allows large or irregular shaped castings to be operated upon.

The cutters are made of steel, 2 inches square section, doing away with the necessity of expensive machine work in fitting and can be set at right angles to the front of the press if found more convenient. The adjustment of the cutters permits their use up to the last inch, and and they may be accurately set to just cut off the gate without touching each other, thus preserving the cutting edges. The machine has also eccentric adjustment above on the connecting rod. It is also fitted with patented instantaneous clutch and can be run either continuously or stopped instantaneously at each stroke. This clutch is so designed that there is less than 1/32 inch travel on the periphery of the flywheel after it engages or disengages, insuring a saving in power and the elimination of loss in friction.

The machine weighs 2500 pounds; over all hight, 6 feet; stroke, 1¼ inches; distance between ways, 7¾ inches; depth of throat, 8 inches; floor space necessary, 30x36 inches. It is made by the Standard Machinery Company, 7 Beverly street, Providence, R. I.

## Easily Removable Milling Cutter

The halftone and line engraving illustrate an inserted-tooth side milling cutter

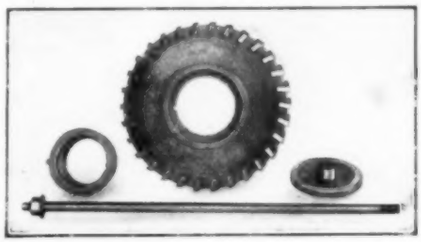


Fig. 1. The Milling Cutter, Sleeve and Clamping Plate

recently brought out by the Brown & Sharpe Manufacturing Company, Providence, R. I., this construction embodying the features of quick release and interchangeability. The cutter is designed to be used on machines of various sized

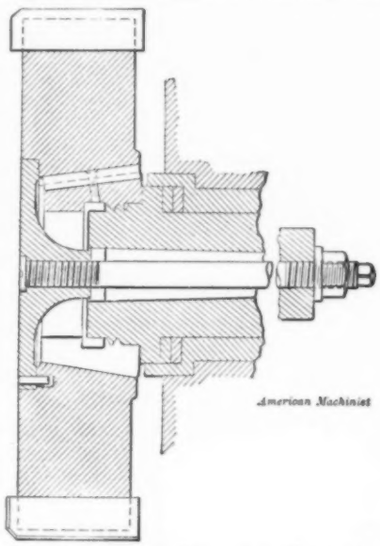
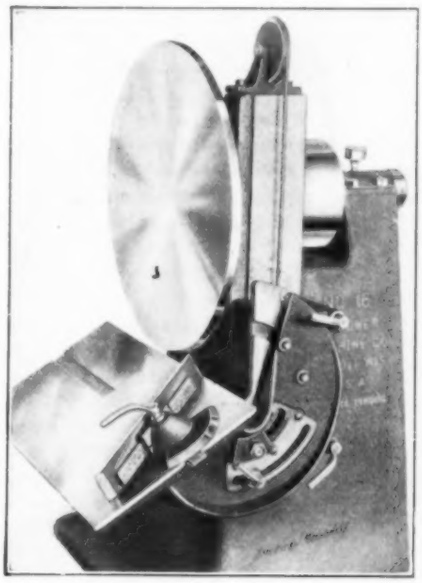



Fig. 2. Section Through Milling Cutter

spindles, take the heaviest cuts and yet be removed without trouble, and is intended, therefore, to reduce the number of cutters necessary to keep on hand, and at the same time save much time now spent in removing cutters after they have been locked tightly to the spindle by some extra heavy cut. As will be seen by reference to the sectional view, Fig. 2, the hole in the cutter is made with a taper, which is sufficiently abrupt to permit ready release, and which fits a tapered, split sleeve of steel, which in turn is screwed to the nose of the spindle. A draw-in bolt and a clamping plate draw the cutter onto the sleeve, to which it is keyed as an extra precaution against turning on the sleeve. When the draw-in bolt is tightened, the sleeve is contracted and grips the spindle tightly. Upon loosening the bolt, when the work is completed, the cutter may be readily removed. It will be noted that the cutter is carried close to the spindle so that it allows the maximum amount of working space. By the use of special sleeves, one cutter can be adapted to fit machines of different sizes of spindles. In such cases, the outer measurement of the sleeve is equal to the size of the hole in the cutter, while the bore of the sleeves is varied to fit the nose of the spindle.

## Patternmaker's Disk Grinder

The Gardner Machine Company, of Beloit, Wis., has recently brought out



Patternmaker's Disk Grinder

the patternmaker's disk grinder, illustrated. While shown with a single disk, it can be furnished as a double-ended machine with another disk wheel on the other end of the spindle. The disks are from 24 to 30 inches in diameter and run at a linear speed of 6000 feet per minute, requiring 5 horsepower as a maximum. The end thrust of the spindle is taken in both directions by one bearing box, there being hardened-steel thrust collars on the spindle, bearing against the babbitt-plugged, cast-iron faces of the one box.

It is claimed that with this construction heating of the spindle will tend to loosen the thrust bearing, rather than cause it to bind.

A notable feature of this machine is the adjustable work table, which may be raised or lowered and tilted to any angle. The weight of the table is counterbalanced and it is locked by two quick-acting tightening bolts. The edge of the table next to the wheel is at the center about which the table swings, thus always keeping the edge close to the wheel. The angle of the table is determined by graduations on the segment.

On the face of the table is a sliding bar, carrying an angle protractor or square gage, which is graduated from zero to 45 degrees, in both directions. This protractor is also reversible, to bring the graduations on either side. One handle locks all of these parts in position.

The disk wheels are permanently attached to the spindle and refacing is done without removing the disk and without the use of a press. The weight of the single disk machine with countershaft is 1200 pounds.

## Harrington Heavy Duty Radial Drill

The machine shown in the halftone is one of a group recently built to drive high-speed drills to the limit of their capacity. In the design, special attention was given to the distribution of metal to prevent deflection under heavy load, that the shafts should have ample strength at the slowest speed, and that the size of the bearings would prevent over heating. All levers for operating have been placed within easy reach of the operator. In an official test of the machine, to determine its strength, several 1½-inch speed drills were driven to destruction under a maximum motor load of 67 horsepower, without any damage to the machine.

The base is deep, with five T-slots, heavy ribs and oil gutter are provided around the edge. The full width is continued under the column, and the motor extension is cast in one piece with the base.

The column is of box section, with large cross bracing, and has a wide face for the arm saddle.

The arm is extremely strong with cross ribs and a large strut to prevent deflection, and is carried on the saddle by ball thrust and roller bearings. The saddle has a long bearing on the column with a vertical power traverse screw which is provided with a friction to prevent overtravel.

The drive is from a variable-speed motor by belt to the top shaft. The gear teeth are coarse pitch and wide face, all mating gears both of drive and feed being of steel and hard bronze. Positive tooth clutches are provided in the head for reversing the drive and for engaging the back gears, both operated by levers at the bottom of the head. Speed variation with and without back gears, is obtained through a drum-type controller mounted on the column. For some uses the regular spindle speeds do not run slowly enough, for which case special gearing with slower initial speed and larger range is provided.

The spindle is of forged high-carbon steel and has ball thrust bearings at both the bottom and top of the sleeve. The portion above the sleeve is squared to fit the hole in the driving gears, eliminating keys.

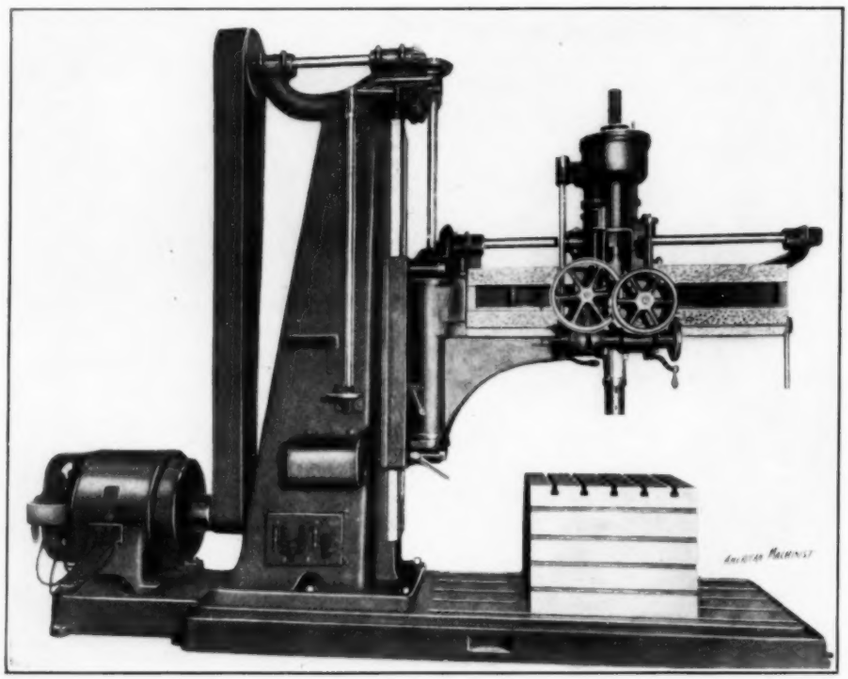
The feed is operated through a train of planetary gearing inside the worm gear, to reduce the worm pressure. Quick return is obtained through a positive tooth clutch between the hand wheel and worm gear, and a clutch of the worm drive disconnects the power for hand feeding. Six changes of feed are provided from 0.0051 to 0.04 inch per revolution, all instantly obtainable.

Tapping is accomplished without extra attachment by the spindle reversing clutch on the horizontal shaft.

The table has straight sides with T-slots for clamping work on both top and side and can be removed from the base when not wanted.

Extra equipment of an oil pump and piping, to a tank in the foundation underneath motor base, can be supplied.

The drills are made in two sizes with 5- and 6-foot arms with greatest distances from spindle to base 6 and 7 feet respectively. The table is the same hight, 24 inches, in both. The spindles are also the same size, 3 inches diameter in the sleeve and have Morse No. 5 taper hole. A 20-horsepower motor is supplied in each case. The machines without motors weigh 17,000 and 18,000 pounds respectively. They are built by Edwin Harrington Son & Co., Inc., Seventeenth and Callowhill streets, Philadelphia, Penn.



A Harrington Heavy Duty Radial Drill

## A Micrometric Plug Gage

This handy little tool was designed to measure small holes or slots as accurately as the ordinary outside micrometer will measure external diameters. The smallest graduation reads 0.0002 of an inch and by estimating between divisions the instrument may be read to ten thousandths.

By its use a hole or slot can be completely explored to the bottom and accurately tested for roundness, or changes in diameter or width. The instrument is so delicate that roughnesses in an apparently smooth hole can readily be detected and measured.

A Micrometer Plug Gage

It is nearly as rigid as a plug gage and has the advantage that intermediate sizes can be measured with accuracy.

The instrument consists of three principal parts: a body, a taper spindle and a graduated barrel. The body is split at one end to allow of enlargement in screwing in the taper spindle. The exact amount of this enlargement is measured by the graduated barrel mounted on and

locked by a set screw to the other end of the spindle.

The barrel is graduated with ten numbered divisions, reading thousandths, each of which contains five subdivisions representing 0.0002 each.

The datum line of the instrument is the point of intersection of the vertical zero line and the horizontal line on the body. Set screws are provided to lock the parts in place after adjustment.

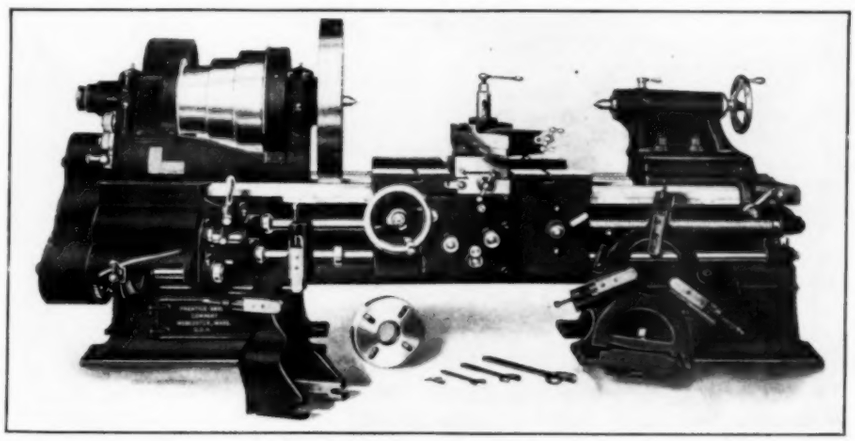
The taper on the spindle wedges out the split part of the body in proportion to the amount the spindle is screwed in, one complete revolution of the spindle changing the diameter of the end 0.01 of an inch.

The instruments are furnished in sets or singly, each one having a range of about 1/32 inch above and below its marked size. They are carried in stock in sizes from ¼ to 1 inch, but larger sizes can be had to order. They are made by the Nash Engineering Company, 248 Gates avenue, Brooklyn, N. Y.

## A Double Back-geared Lathe

The halftone shows a new double back-geared lathe which has been brought out by the Prentice Brothers Company, Worcester, Mass.

The lathe is equipped with quick-change gear mechanism giving 36 changes of lead for screw cutting from 1 to 16 threads per inch. The lead screw is large and of coarse pitch. It is rotated when screw cutting only.



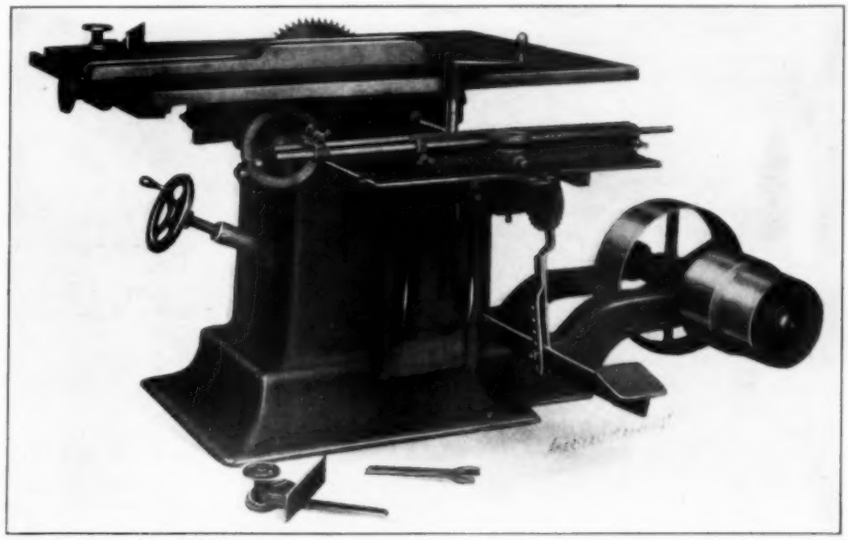
DOUBLE BACK-GEARED LATHE

The spindle is of high-carbon steel, the front bearing being 4¾ inches diameter by 7½ inches long. The spindle has a 2½-inch hole through it. The spindle bearings are of hard bronze. The end thrust of the spindle is taken by a step bolted to the end of the headstock and entirely independent of the spindle. The tailstock is of the offset type, permitting the compound rest to be set parallel with the bed.

An automatic stop is provided for the feed, which disengages the clutch on the feed rod. Taper attachment can be furnished at extra cost. While nominally this is a 27-inch lathe, it will swing 30 inches over the ways, 18¾ inches over the compound rest and with 12-foot bed it takes 78 inches between centers and weighs 7560 pounds.

## A Variety Saw for Pattern Shops, etc.

The halftone shows a variety saw built by the B. M. Root Company, York, Penn.



VARIETY SAW FOR PATTERN SHOP

The countershaft is mounted on an extension of the base as shown. The upper part of this base is planed to fit the planed base of the machine proper. An endless belt can be used from the counter to the mandrel pulley, as the machine is adjustable on the base by means of a screw. Instead of lifting the table, the mandrel bearings are mounted on a slide and the saw is raised or lowered as desired by the handwheel at the left, maintaining a constant table hight. The slide upon which the saw-mandrel bearings ride is so positioned as not to affect the tightness of the belt.

The table tilts to an angle a little greater than 45 degrees, and is graduated for accurate setting. The tilting is accomplished by means of the worm and worm-gear under the table, which is self locking in any position. Gages are provided for ripping, crosscutting or mitering. For ordinary ripping the gage is instantly adjustable to approximate position, for accurate work a screw-actuated micrometer gage is provided. The gages can be used on either side of the saw, grooves being provided for that purpose. On the side of the machine, the foot-operated boring attachment, shown in the halftone, can be fitted at any time. Adjustable stops are provided for boring. The machine will swing an 18-inch saw, but a 14-inch saw is generally used, and with it material 4 inches thick can be ripped or crosscut.

A new development in the way of a process for hardening gold and silver has been receiving attention recently, and according to the *Brass World*, the process holds out considerable promise, its advent being of much importance as it indicates a field yet untouched in the metallurgy of the noble metals, and it is probable that many other new uses can be found for them in the alloyed and hardened state.

Hardened gold has thus far found its widest use in the manufacture of surgical instruments. Thousands of hypodermic needles made by the process are in use. They are made of the gold and then drawn down to the required size. A special alloy, somewhat softer than the cutting instruments, is necessary for this purpose, and yet the needles are as stiff as if made of steel. The fact that the gold is not attacked by liquids used in the needles really demands that they shall be employed in a hypodermic syringe.

# Increasing Shop Capacities

## Where More Tools Will be Needed

*Authentic news is solicited for this department. Real opportunities for the sale of machinery of any kind.*

Elmer Wiltse, Ceylon, Minn., will erect a blacksmith shop.

The Duluth (Minn.) Auto Company will build a new garage.

The Caledonia (Minn.) Creamery Company will build a creamery.

The Madison (Wis.) Cold Storage Company will erect a plant.

Novotny & Sons will erect a blacksmith shop at Montgomery, Minn.

Nonotuck Silk Company, Leeds, Mass., will build an addition to its mill.

The Supreme Stove Company, Welland, Ont., is erecting an addition.

The National Glove Company, Columbus, Ohio, will erect a new factory.

F. P. Carrier, Edgerton, Wis., is erecting an addition to its machine shop.

The Heaney Lamp Company, Weehawken, N. J., is to erect a new factory.

The Manchester (Minn.) Creamery Association will erect a $10,000 plant.

The Morrison Boiler Works, Dubuque, Iowa, is erecting an addition to its plant.

An addition is being built to the tannery of Geo. C. Vaughn, Salem, Mass.

The Racine (Wis.) Iron and Wire Company will erect a $10,000 factory.

The Kelly Steel Burial Vault Company is building a plant at Bucyrus, Ohio.

The Ohio Leather Company, Girard, Ohio, is to erect another factory building.

The Acme Shear Company, Bridgeport, Conn., will erect a foundry building.

The Northampton Silk Company is building a new factory at Florence, Mass.

The Fair City Bott'ing Works, Huron, S. D., will erect a two-story factory.

The Indian Refining Company will locate a large branch plant in Rochester, N. Y.

August Brawn, of Sturgeon Bay, Wis., is planning to establishe a box factory.

The Birnie Paper Company, Brightwood, Mass., will erect a three-story addition.

The Northern Turpentine Company will build a $250,000 plant at Kass, Mich.

The Mandt Wagon Company, Stoughton, Wis., will build a new blacksmith shop.

The Goshen (Ind.) Buggy Top Company is contemplating an addition to its plant.

The W. W. Wood Company, of Raymond, Wash., will build a $30,000 veneer plant.

The Great Northern Railway is to build a new roundhouse at Grand Rapids, Minn.

The Model Laundry Company, Cincinnati, Ohio, will erect an addition to its plant.

The Peacock Iron Company, Selma, Ala., is looking for suitable site for a new plant.

The Standard Harrow Company, of Utica, N. Y., is to move its plant to St. Paul, Minn.

The city council, Grand Island, Neb., has decided to erect another waterworks plant.

The Binghamton (N. Y.) Lounge Company is receiving bids for an addition to its plant.

The Chicago & Northwestern Railroad will erect a sixty-five stall roundhouse at Fulton, Ill.

The plant of the Art Metal Manufacturing Company, Newark, N. J., was destroyed by fire.

The Mengel Box Company, of Louisville, Ky., is building a factory at Hackensack, N. J.

The Mayer Boot and Shoe Company, Milwaukee, Wis., will erect an eight-story factory.

The Ivens Machine Company, Trenton, N. J., is building an addition to its machine shop.

The Wisconsin Condensed Milk Company, Burlington, Wis., is looking for site for a new plant.

The Standard Inlaid Oilcloth Company, Trenton, N. J., is building an addition to its plant.

The Chippewa Shoe Manufacturing Company, Chippewa Falls, Wis., will erect a plant.

The Pioneer Pearl Button Company, Muscatine, Iowa, is looking for site for a new plant.

The Union Fork and Hoe Company, Columbus, Ohio, is planning the erection of an addition.

Fire destroyed the plant of the Fairfield Paper Company, Coshocton, Ohio. Loss, $17,000.

The Camden (N. J.) Forge Company has taken out a permit for the erection of a new building.

The Oswald Motor Works, Goshen, Ind., is contemplating the erection of an addition to its plant.

The plant of the Standard Lumber Company, Dubuque, Iowa, was burned. Loss, $100,000.

The plant of the Des Moines (Iowa) Iron and Bridge Works, on Neville Island, is to be enlarged.

The Lake Erie & Western Railroad is erecting a five-stall addition to its roundhouse at Muncie, Ind.

The Wausau (Wis.) Street Railway Company will erect a 7000-horsepower plant at Mosinee, Wis.

Broderick & Quinlan, boiler manufacturers, Muncie, Ind., is seeking site for a new and modern plant.

The plant of the Christy Knife Company, Fremont, Ohio, recently burned, is to be rebuilt immediately.

The plant of the Pittsburg (Penn.) Plate Glass Company was destroyed by fire. Loss, about $1,000,000.

The plant of the De Witt Motor and Vehicle Company, North Manchester, Ind., was destroyed by fire.

The National Straw Works, Milwaukee, Wis., will spend about $18,000 for additions and improvements.

The Santa Fe Railroad has awarded contract for the erection of shops and roundhouse at Sweetwater, Tex.

Edward Fay & Son, Philadelphia, Penn., carpenters and builders, will erect a factory at 1027 Vine street.

W. R. Thropp & Son, Trenton, N. J., will build an addition to its machine shop to be used as a tool room.

The Cincinnati (Ohio) Traction Company will spend $1,500,000 on new barns and power-house equipment.

The General Fire Extinguisher Company, of Providence, R. I., is erecting an addition to its plant at Auburn.

The Robert D. Clark Thread Company, Chester, Penn., recently incorporated, is looking for site for a plant.

The Lawton Spinning Company, Woonsocket, R. I., is planning to spend $78,000 in extensions to its plant.

Lloyd & Richardson, tanners, Camden, N. J., has had plans prepared for a new plant to consist of five buildings.

The Waterbury (Conn.) Clock Company has awarded the contract for the erection of a new five-story factory.

William Gibbs, of Hawley, Penn., is looking for site for a new cut-glass factory to employ at least 100 men.

The Southwestern Broom Company, Evansville, Ind., will erect a factory at Baltimore, Md., at a cost of $100,000.

Fire damaged the plant of the National Woolen Company, Waterville, Me., to the extent of about $30,000.

The Schuatt Chocolate Manufacturing Company, Trenton, N. J., will build a new factory and power plant.

The Trip Carrier Manufacturing Company, Rice Lake, Wis., will erect a foundry for the manufacture of its castings.

Roach, Tisdale & Co., Minneapolis, Minn., confectionery manufacturers, will erect a five-story factory to cost $60,000.

The Gem Upholstering Company, Milwaukee, Wis., has secured a permit for the erection of a $15,000 factory.

The Appleton (Wis.) Surface Coated Paper Company will build an addition and install new engine, boiler, etc.

Fire did $20,000 damage to stock and machinery at the plant of the Martin Kelley Shoe Company, Danvers, Mass.

The New Orleans (La.) Charity Hospital will install two 100-kilowatt generators and engines for lighting and power.

The American Locomotive Company is now erecting a new building at Providence, R. I., for its automobile department.

The Elmore Automobile Company which is a part of the General Motor Company, has purchased site at Clyde, Ohio.

The Samuel Morris Company, Newark,

N. J., manufacturing gas and electric fixtures, is seeking site for a new plant.

The plant of the Dewitt Automobile Company, North Manchester, N. H., was burned. Loss, $13,000. Will be rebuilt.

The Easthampton Gas Company has awarded contract for the construction of a new power house at Mt. Tom, Mass.

The Atikokan Iron Company is to build 100 more ovens in connection with blast-furnace plant at Port Arthur, Ont.

The Syverson Lumber and Shingle Company, Montesano, Wash., will erect a sawmill and planing mill to cost $65,000.

Ernest J. Knabe, Jr., 829 Park avenue, Baltimore, Md., is interested in the establishment of a new piano factory.

It is stated the Fairfield (Conn.) Aluminum Company is considering the removal of its plant to some other locality.

Voss Bros. Manufacturing Company, Davenport, Iowa, manufacturing washing machines, will erect a new factory.

The American Seeding Machine Company, Richmond, Ind., has been granted permit for its new addition to cost $90,000.

The Western Storage Battery Company, Kansas City, Mo., is trying to secure suitable site for a new and larger plant.

The Dain Manufacturing Company, Welland, Ont., is extending its plant for the manufacture of manure spreaders.

William F. Read & Son, commissioners and manufacturers of dry goods, will erect a five-story factory to cost $40,000.

The Schacht Manufacturing Company, Cincinnati, Ohio, will erect a $100,000 automobile plant on Spring Grove avenue.

The Rhinelander (Wis.) Iron Company is building a shop to be used for general repairing, including automobile work.

The Maple Leaf Milling Company, Fort William, Ont., will erect a $100,000 flour mill and elevator at Port Colborne.

J. F. Heiberg and others, at Heiberg, Minn., are figuring on building a factory for the manufacture of starch from potatoes.

The Overland Motor Car Company, of Cleveland, Ohio, is planning the establishment of a large plant in Portland, Ore.

The sawmill and stave factory of John Pierson, at Stevensville, Ont., was destroyed by fire, causing a loss of about $10,000.

The Buck Stove Company, Kansas City, Mo., will erect a new plant. This is to consist of five buildings and cost $200,000.

The Canton (Ohio) Sheet Steel Company, recently incorporated, will establish a plant. The company is capitalized at $500,000.

The Republic Iron and Steel Company will build a series of finishing mills in connection with its new plant at Lansingville, Ohio.

The American Vanadium Company has purchased more land adjoining its plant at Bridgeville, Penn., for extension purposes.

The National Carbon Company, having plans in Cleveland, Fremont, Ohio, and other places, will erect a plant in Niagara Falls.

The Anderson Furnace Company, Salem, Ore., has incorporated and will erect a new factory for making warm-air furnaces, etc.

The Kimo Shoe Polish Company, Buffalo, N. Y., is having plans prepared for a three-story factory at Main and Fillmore streets.

Work has been commenced on a new power house for the Hamilton Woolen Company, Southbridge, Mass. This is to cost $20,000.

The Norfolk & Western Railway has awarded contract for the construction of a power house in Roanoke, Va., to cost $26,000.

The bottling and storage houses of Anheuser-Busch Brewing Company, St. Louis, Mo., were destroyed by fire. Loss, $500,000.

The Maumee Electric Company, Toledo, Ohio, has increased its capital and is preparing to erect a hydroelectric plant near Toledo.

The Ware Grain Binder Attachment Company, Minneapolis, Minn., is considering the erection of a $25,000 plant at Aberdeen, S. D.

The Public Service Corporation, of New Jersey, will build a large machine shop near the Market Street Gas Works in Newark, N. J.

The Geyser Oil Tank Company, Fort Wayne, Ind., is making investigation for securing suitable site for a larger and more modern plant.

The Illinois Bolt, Nut and Forging Company, of Chicago, Ill., will move to Hammond, Ind., where a new plant is being erected.

The George Cutter Company, South Bend, Ind., is erecting a foundry to be used for the manufacture of poles and brackets for street lighting.

The Stover Engine Works, Freeport, Ill., which is now erecting an addition to its plant, contemplate the erection of more buildings.

The Jamestown (N. Y.) Wheel and Manufacturing Company is said to be looking for a suitable location on which to erect a modern plant.

The Pittsburg (Penn.) Piping and Equipment Company has awarded contract for the construction of a machine shop and pipefitting room.

The Abingdon (Ill.) Seat and Tank Company is said to be considering moving its plant to another location or establishing a branch plant.

The R. J. Reynolds Tobacco Company, Winston-Salem, N. C., is in the market for a small steam-driven air compressor, about 150 feet capacity.

The Chandler & Art Brass Manufacturing Company, Richmond, Ind., is said to be considering the removal of its plant to some other locality.

The American Lace Manufacturing Company, Elyria, Ohio, is making investigations, preparatory to securing site for a new and modern plant.

The Trenton (N. J.) Spring Mattress Company will build an addition to its plant, also erect a new power house and install new engine and boiler.

The Northern Pacific Railway is erecting a foundry at Brainerd, Minn., to produce daily 50 tons of gray-iron castings and six tons brass castings.

C. J. Spillman, Sidney, Ohio, has invented and patented a scenery-hoisting machine and will organize company for the purpose of manufacturing same.

Griggs & Cooper Company, of St. Paul, Minn., will erect a new $500,000 plant, including canning building, candy-making building, box factory, etc.

The plants of the Cincinnati Roofing, Tile and Terra Cotta Company, and the Freund Roofing Company, at Cincinnati, was burned. Loss, about $150,000.

The A. P. Witteman Company, of Philadelphia and Chester, Penn., will establish a plant at Portsmouth, N. H., for the manufacture of drop forges.

W. R. Harrison & Co., Massillon, Ohio, manufacturers of agricultural implements, are erecting a plant to replace the one destroyed by fire some time ago.

The Quinsigamond Pressed Steel and Tool Company, Worcester, Mass., making pressed-metal goods and machinists' tools, will erect an addition to its plant.

The machine shop and electrical department, at the plant of the Thomas Steel Company, at Niles, Ohio, were burned, causing a loss of about $20,000.

The furnace and dipping department of the Wheeling Metal and Manufacturng Company, at Glendale, W. Va., was destroyed by fire, causing a loss of $12,000.

The North & Judd Company, New Britain, Conn., is having plans drawn for an addition to its annealing room and is also planning addition to brass foundry.

William F. Marresford, Pearl and Water streets, Brooklyn, N. Y., manufacturing machinery for paper-working trades, will erect a factory in Easton, Penn.

Rodyhouse, Arey & Co., Philadelphia, Penn., have contracted for the construction of a ten-story building for the Henry C. Lea estate. Power plant will be installed.

The city of Cotulla, Tex., is prepared to grant a franchise for the installation of an electric-light and water system. C. F. Binkley, mayor, can give information.

The Waterloo, Cedar Falls & Northern Railway Company, of Waterloo, Iowa, will spend $285,000 on improvements, including an addition to its power house.

The Hobbs Manufacturing Company, 26 Salisbury street, Worcester, Mass., has erected an addition to be used for the manufacture of stamp and ticket-vending machines.

James Brothers Company, manufacturing coated papers and gum labels, and the Silicate Paint Company, Ltd., of London, Eng., will establish plants in Newark, N. J.

The New York Veneer Seating Company, whose plant burned a short time ago, will erect a $200,000 plant at Pacific avenue and the Central Railroad, Jersey City, N. J.

The Northwestern Sheet Metal and Iron Company, backed by Minnesota and Iowa capitalists, will erect a factory at Wahpeton, N. D., to be ready for operation June 1.

The American Manufacturing Company, St. Louis, Mo., manufacturing cordage, twine, etc., is looking for site in the New England section for establishing a branch plant.

Mr. Cameron, Beverly, Mass., manufacturer of the Cameron car, is looking for site on which to establish a plant for the manufacture of automobiles, marine engines, etc.

The Drummond Electric Light Company, of Lincoln, Neb., has been granted a franchise by the city council, of Sterling, Ill., to construct and operate an electric-light plant.

Plans are being prepared for a one-story factory, 58x123 feet, and two smaller buildings for the Mitchell Varnish Works, at River avenue and State street, Camden, N. J.

Tenders will be received up to 5 p.m., May 23, by W. A. Duncan, city clerk, New Westminster, B. C., for 25 tons 6-inch and 6 tons of 4-inch cast-iron water pipe 9/16 inch thick.

Abram Marcus, of New Brunswick, N. J., has taken over the Somerset distillery property at East Millstone, N. J., which will be occupied by the Harmer Rubber Reclaiming Works.

The Oscar Lear Automobile Company, Springfield, Ohio, has increased its capital stock and will make improvements to its plant, which manufactures motor trucks exclusively.

The Isthmian Canal Commission, Washington, D. C., will receive bids until 10:30 a.m., June 1, for malleable-iron castings, repair parts for flat and dump cars as per Circular No. 581.

The Federal Crate and Basket Company, of Hartford, Conn., has leased the S. H. Fish basket factory at Sodus, N. Y., and will greatly increase the business. An addition will probably be rebuilt.

Wright & Osborne, truck manufacturers, Mexico, N. Y., will move to Newark, N. Y., where a new plant will be erected. Auto trucks, spring trucks and contractors' road wagons will be manufactured.

Eugene Sibley, of Detroit, Mich., has organized the Sibley Motor Car Company, and will establish a factory at Solvay and Mackie avenues, in the buildings formerly occupied by the Detroit Valve and Fitting Company.

Sealed bids will be received by the Board of Control, Winnipeg, Man., until 12 o'clock noon, May 16, for the erection of a substation. Plans can be obtained of Smith, Kerry and Chace, Carnegie Library building, Winnipeg.

Sealed proposals will be received at the office of the assistant purchasing officer, Panama Railroad, 24 State street, New York, until 2 p.m., May 16, for furnishing miscellaneous railway supplies as per circular No. P-285.

Fire destroyed the plants of the Wisconsin Chair Works and the C. F. Meyer Tight Stave Works, at Mound City, Ill., causing a loss of $150,000. The chair factory was being enlarged for the manufacture of wooden automobile bodies.

Sealed proposals will be received at the office of the constructing quartermaster, Fort Crockett, Galveston, Tex., until 2 p.m., May 31, for the construction of an electric-lighting system. Information can be had of Capt. P. Whitworth.

Sealed proposals will be received at the office of constructing quartermaster, Fort Dade, Egmont, Fla., until 10 a.m., May 20, for the construction of lighting system at Fort Dade, including transformers, engines generators, etc.

Joseph S. Mack, president of the United States Textile Corporation, and at the head of the Mack Brothers Motor Truck Manufacturing Company, 50 Church street, with factory at Allentown, Penn., is seeking sites for branch plants in Canada.

The Jas. L. Morrison Machine Company, 52 Fulton street, Paterson, N. J., has purchased the business of E. Gerber, and will engage as general machinists and manufacturers of silk, dyeing and finishing machinery. Will need some new equipment.

The Hotchkiss Lock Metal Form Company, 56 Front street, Binghamton, N. Y., recently incorporated, which is having its forms manufactured by another concern, is said to be considering the establishment of its own plant. The forms are used in sidewalk construction.

Sealed proposals will be received at the office of constructing quartermaster, 482 Arcade Annex, Seattle, Wash., until 11 a.m., May 28, for the construction of a water system at Fort Ward, Wash. Information can be had of Capt. E. C. Long, constructing quartermaster.

Proposals will be received at the Bureau of Navigation, Navy Department, Washington, D. C., until 12 o'clock noon, May 25, for a railroad-track scale at the Naval Training Station, Great Lakes, North Chicago, Ill. Blank forms can be had of the commandant at the station.

Sealed proposals will be received until 10 oclock p.m., June 1, at the Benicia Arsenal, Benicia, Cal., for supplies for year ending June 30, 1911, including steel, hardware, leather, oils, electrical supplies, etc. Information can be had of Lieut. Col. J. W. Benet, commanding officer.

Sealed proposals will be received at the office of the constructing quartermaster, Fort Sam Houston, Tex., until 11 a.m., June 4, for pumping, ice and ice-storage plant and laundry with laundry machinery complete. Information can be obtained of J. W. Gurney, constructing quartermaster.

The New Era Gas Engine Company, Dayton, Ohio, has sold its auto-cycle business. New capital has been interested and plans are being made for equipping a new factory for the manufacture of its gas and gasolene engines. Catalogs and prices are wanted on all sorts of small tools and appliances.

The Acme Lubricator Company, Real Estate Trust building, Philadelphia, Penn., will erect a two-story addition to its plant at Sixty-first street and Girard avenue, to be used for general manufacturing purposes. Small machine-shop equipment will be installed, and it is said, brass foundry will be added later.

The Isthmian Canal Commission, Washington, D. C., will receive bids until 10:30 a.m., June 4, for supplies for year ending June 30, 1911, including nails, screws, belt rivets, cotters, padlocks, oil cans, oilers, torches, locomotive headlights, lanterns, steam gages, grease cups, clocks, cars, leather belting, etc., as per Circular No. 583.

The United States Motor Company, which recently purchased the truck plant of the Alden Sampson Manufacturing Company, at Pittsfield, Mass., has announced that it will erect a large plant in Detroit, Mich., for the manufacture of commercial vehicles exclusively, maintaining the Pittsfield plant where heavy-duty trucks will be manufactured. The Detroit plant to be used for light-delivery wagons will cost $2,000,000.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 10:30 a.m., May 24, for steel flat cars, steel castings, bronze, rivets, drift bolts, nails, tacks, wire, pipe and fittings, valves, cocks, drills, stocks and dies, taps, lathe dogs, wrenches, hammers, saw blades, vises, warehouse trucks, gasolene furnaces, force cups, oils, cans, hinges, door knobs, steel tapes, belting, belt dressing, etc., as per Circular No. 582.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: May 17—1450 pounds high-speed steel, 1800 pounds carbon-tool steel (schedule 2445), 47,900 pounds special crucible steel, 15,550 pounds steel and locking ring tube (schedule 2442), cable and wire (schedule 2441), 1800 pounds copper wire (schedule 2443), 21 forges for fuel oil (schedule 2444), No. 3 improved variety lathe, lock corner machine, dado machine, five heads, wire-cutting and straightening machine, double cutoff saw (schedule 2436), pipe-expanding and flanging machine (schedule 2437); June 7—Upright drill (schedule 2440), high-duty crank shaper (schedule 2440).

## BUSINESS ITEMS

Marsh Brothers & Co., Ltd., Sheffield, Eng., has appointed the Specialty Supply Company, 277 Greenwich street, New York, its American agents.

The Ingersoll-Rand Company announces the removal of its Chicago office from the Old Colony building to the Peoples Gas building, Suite, 1503-7, 150 Michigan avenue.

The S. Obermayer Company, manufacturers of foundry facings, supplies and equipment, Cincinnati, has furnished a complete foundry equipment for the battleship "Dixie." This portable foundry was installed on this battleship so that all necessary repairs can be made when at sea.

## NEW INCORPORATIONS

Dayton Ice Machine Company, Dayton, Ohio. Capital, $50,000. Incorporators, Joseph Meyer, W. C. Hiester, Jr., Chas. N. Lupton, etc.

Electric Specialty Company, Cleveland, O. Manufacture electrical articles. Capital, $10,000. Incorporators, E. Younger, R. L. Palmer, T. P. Fease.

The Dubs and Arnold Pattern Company, Canton, Ohio. Manufacture patterns. Capital, $10,000. Incorporators, E. E. Arnold, W. V. Arnold, E. E. Dubs, etc.

Hamilton Caster and Manufacturing Company, Hamilton, Ohio. Manufacture metal specialties. Capital, $10,000. Incorporators, C. A. Weigel, A. Krogmann, etc.

Dusseau Motor Car Company, Toledo, Ohio. Operate garage and deal in automobiles. Capital, $30,000. Incorporators, S. W. Dusseau, M. G. Dusseau, A. J. Marleau, etc.

Latty Manufacturing Company, Ellicottville, N. Y. Manufacture tacks, nails, staples. Capital, $15,000. Incorporators, W. D. Walrath, C. A. Case, G. F. Latty, etc.

Benton Ice and Cold Storage Company, Benton, Ill. Ice, cold storage, etc. Capital, $20,000. Incorporators, Chas. E. Hamilton, F. O. Hamilton, W. W. Hamilton.

American Wrapping Machine Company, St. Louis, Mo. Manufacture wrapping machines. Capital, $50,000. Incorporators, H. Sterling Wilson, D. S. Brackett, M. D. Gibson.

Sweeney Automobile Company, Camden, N. J. Manufacture automobiles, motor cycles, etc. Capital, $10,000. Incorporators, T. R. Hansell, John A. MacPeak, Wm. F. Eidell.

Monarch Manufacturing Company, Bascom, Ohio. Manufacture extension ladders, washboards, etc. Capital, $10,000. Incorporators, J. G. Hough, David Kinger, A. D. Myers.

Lexington Clay Products Company, Lexington, Ohio. Manufacture brick, tile, sewer pipe, etc. Capital, $100,000. Incorporators, J. J. Harkins, W. J. Frazer, J. N. Nelson.

Bradley Rust Proofing Company, 35 Ferris street, Brooklyn, N. Y. Manufacture rust-proof process for metal parts. Capital, $100,000. S. L. Platt, assistant treasurer.

Edwards Instrument Company, Indianapolis, Ind. Manufacture surgical instruments and appliances. Capital, $20,000. Directors, G. E. Turner, C. M. O'Donnell, C. E. Averill.

Dominick Automobile Company, Chicago, Ill. Automobile business, general repair and machine shop. Capital, $10,000. Incorporators, W. F. Dominick, G. B. Wood, J. W. Ross.

Star Manufacturing and Foundry Company, Newbury Heights, Ohio. Operate foundry and machine shop. Capital, $15,000. Incorporators, Frank Suchanck, F. Cook, Mike Cevensky, etc.

Metals Welding Company, Cleveland, Ohio. Manufacture and deal in metal-welding and brazing machinery. Capital, $50,000. Incorportors, J. M. Garfield, Grover Higgins, G. M. Cummings, etc.

Specialty Paper Company, Huntington, Conn. Manufacture pulp and paper. Capital, $150,000. Incorporators, J. A. Wilkinson, Huntington; J. B. Thompson, West Newbury, Mass., etc.

Modern Transmission Mechanism Engine Company, New York. Manufacture and deal in motors, engines, pumps, etc. Capital, $25,000. Incorporators, G. R. Jaeger, F. W. Jaeger, F. Eveland.

W. A. Wood Automobile Manufacturing Company, Kingston, N. Y. Manufacture automobiles, engines, etc. Capital, $3,000,000. Incorporators, W. A. Wood, C. W. Kahlereth, F. Fitch, New York.

The Eastern Machine Screw Company, New London, Conn. Manufacture machine screws, etc. Capital, $100,000. Incorporators, N. S. Lippitt, of Norwich; W. S. Garde, S. Youngman, of Hartford, etc.

Sandusky Auto Parts and Motor Truck Company, Sandusky, Ohio. Manufacture parts for automobiles and motor trucks. Capital, $12,000. Incorporators, as. M. Wood, D. E. Storms, O. F. Snyder, etc.

Cortland Motor Wagon Company, Cortland, N. Y. Manufacture and deal in automobiles and accessories. Capital, $100,000. Incorporators, R. H. Jadwin, Scranton, Penn.; L. O. Meacham, H. Duffey, Cortland.

Horseshoe Auto Tire Company, New York. Manufacture and deal in automobiles, supplies, tires. Capital, $25,000. Incorporators, W. E. Holloway, W. Huber, New York; H. D. Foster, Tompkinsville, S. I.

Flexible Abrasive Wheel Company, Newark, N. J. Manufacture flexible abrasive wheel, metal- and wood-polishing machinery. Capital, $10,000. Incorporators, A. W. Taylor, E. L. Clark, W. H. Jeffers.

New Haven Sand Blast Company, New Haven, Conn. Manufacture the Dreis Lach patent sand-blast rolling barrel. Capital, $25,000. Incorporators, Wm. F. Smith, Chas. A. Dreisbach, George E. Tucker.

Inter-Eastern Paper Box and Machine Company, New York. Manufacture and deal in machinery for making paper boxes, etc. Capita' $20,000. Incorporators, M. C. Miller, Toledo, Ohio. A. J. Selz, J. E. Carr, New Rochelle, N. Y.

Long Island Automobile, Machine and Plumbing Company, Amityville, N. Y. General automobile and motor-boat business, general plumbing business. Capital, $15,000. Incorporators, Thos. Blyth, 126 East End avenue, New York; W. E. Hulse, Amityville, N. Y., etc.

Wappler Electric Manufacturing Company, New York. Manufacture and deal in electrical machinery of all kinds, also electrical apparatus for surgery, etc. Capital, $150,000. Incorporators, C. B. Stackpole, New York; W. W. Hoag, New Rochelle; H. B. McKenzie, Brooklyn, N. Y.

## TRADE CATALOGS

The Joyce-Cridland Company, Dayton, Ohio. Catalog A, describing lifting jacks. Illustrated, 96 pages, 4x9 inches, paper.

Morse Chain Company, Ithaca, N. Y. General Bulletin No. 9. Silent running flexible gearing. Illustrated, 30 pages, 6x9 inches.

Columbia Tool Steel Company, Chicago, Ill. Pamphlet entitled, "The Art of Making Tool Steel." Illustrated, 16 pages, 5x8 inches, paper.

Gannett Electrical Company, 55 Pine street, Providence, R. I. Circular illustrating and describing Gannett handy truck for moving machinery.

Thos. L. Dickinson, 64 Nassau street, New York. Catalog of diamond tools for dressing, truing and shaping. Illustrated, 20 pages, 3½x6 inches, paper.

International Acheson Graphite Company, Niagara Falls, N. Y. Folder describing Gredag for use on high-grade machinery, automobiles, etc. Booklet describing Oildag. Thirty-two pages, 3½x6½ inches, paper.

## FORTHCOMING MEETINGS

National Association of Manufacturers, annual meeting, Waldorf-Astoria hotel, May 16, 17 and 18, 1910. Geo. S. Boudinot, secretary, 170 Broadway, New York City.

National Machine Tool Builders' Association, spring convention, May 24-25, Rochester, N. Y. Charles E. Hildreth, Worcester, Mass., secretary.

American Society of Mechanical Engineers, spring meetings, Atlantic City, N. J., May 31-June 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

## WANT ADVERTISEMENTS

*Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.*

## Miscellaneous Wants

Caliper catalog free. E. G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Mechanical engineer wants to correspond with firms desiring to build pumps, compressors and engines of new designs and of exceptional merits. Box 460, AMER. MACH.

Will travel four months in Europe; would like to introduce tools, machinery, or represent American firms; uptodate machine man; speaks several languages. Box 507, AM. MA.

Wants to sell outright or on royalty a patent on power hammer; length of stroke regulated by foot treadle, opening between dies can be changed during operation of hammer. Box 500, AMERICAN MACHINIST.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

Proposals for ordnance supplies. Watervliet Arsenal, Watervliet, N. Y., April 16, 1910: Sealed proposals, in triplicate, will be received until 1 p.m., May 16, 1910, for furnishing steel, hardware, forage, fuel, oils, etc., during year ending June 30, 1911. Information furnished on application. Lieut.-Col. W. W. Gibson, Commander.

## Help Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Petersboro, Ont.

Wanted — Experienced mechanical draftsman and designer, with technical and practical training, for position in large Canadian concern manufacturing a number of heavy lines; sawmill and pulp mill machinery, boilers of all types, engines and special work; good prospects for right party; also wanted, two junior draftsmen with some drafting room and practical experience. Box 492, AMERICAN MACHINIST.

CONNECTICUT

Wanted—Draftsmen on automatic machinery; state age, experience and wages expected. Box 479, AMERICAN MACHINIST.

Working foreman experienced in work of high accuracy, on automatic screw machines, milling and grinding; state age, experience, salary and references. Box 452, AM. MACH.

ILLINOIS

Wanted—High grade man as assistant superintendent in adding machine factory; must furnish best of references. Box 510, AM. M.

INDIANA

Wanted—First-class screw and turret lathe foreman; must be competent in uptodate methods and capable of getting results. Nordyke & Marmon Co., Indianapolis, Ind.

MICHIGAN

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—Draftsman, experienced general and detail designer heavy machinery; good wages; steady employment with firm located in city of Detroit; state experience. Address P. O. Box 582, Detroit, Mich.

Wanted—One of the oldest and best established companies in the Middle West seek the services of a general foreman for their machine shop; about 350 are employed in the department, and building and equipment are thoroughly modern; the nature of the work varies from a line similar to automobiles and manufactured in large quantities, to a medium heavy plain class of railway equipment; none but high grade men apply, as the position is an important one and requires a man of broad experience. Box 415, AM. MACH.

MISSOURI

Wanted—Experienced draftsman; good on designing jigs and fixtures; one capable also of laying out small experimental work, such as desired in adding machine construction; state fully, experience and salary desired. Dalton Adding Machine Company, Poplar Bluff, Mo.

NEBRASKA

First-class automobile machinists and toolmakers. Apply to C. M. Mohler, Ralston, Neb.

NEW JERSEY

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands; also tool and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia).

NEW YORK

Wanted—Draftsman, experienced in boiler and plate work; state age, experience, references and previous salary. "B. D.," AM. MA.

Wanted—First-class machinist to run Acme automatic screw machines; state experience in full and give references. Box 491, AM. M.

Gear cutting machine salesman wanted; smart, live salesman of good address wanted, with good connections in East; state age, experience, salary. "Push," AMER. MACHINIST.

Wanted—Tool or die makers accustomed to very close and accurate work; first-class men only; good wages; steady position. Doehler Die Casting Co., Court & Ninth Streets, Brooklyn, N. Y.

Wanted—First-class estimator, draftsman and designer for car manufacturing business; good salary and excellent opportunity for competent man. Address Wonham-Magor Car & Mfg. Co., Passaic, N. J.

First-class machinists and tool makers wanted; applicants must state wages desired and give previous experience in order to receive further consideration. Address Ingersoll-Rand Co., Painted Post, N. Y.

Wanted—Toolmakers on model and experimental special automatic machine work; good pay and steady work to competent men; give age, experience and references. Apply: The S. S. White Dental Mfg. Co., Princes Bay, N. Y.

Wanted—A-1 planer hand experienced in working small intricate machine parts on a 26 inch Gray planer without jigs or fixtures; steady work and good wages. Apply, giving experience and references, The S. S. White Dental Manufacturing Company, Princes Bay, Staten Island, N. Y.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

Wanted—Operators for both hand and automatic Brown & Sharpe and Cleveland screw machines; only those versed in uptodate methods need apply; attractive positions and steady employment for sober and industrious men; state where employed for the last three years, wages expected and furnish references, if possible, which, of course, will be in strict confidence. Baush & Lomb Optical Co., Rochester, N. Y.

OHIO

Machinists wanted on tool room work. Box 466, AMERICAN MACHINIST.

Wanted—Mechanical engineer or draftsman for designing and detailing; steady employment; conditions first class. The Toledo Machine & Tool Co., Toledo, O.

Wanted—Expert in factory cost systems and general accounting by prominent manufacturer in Cleveland; give references and experience. Box 493, AMERICAN MACHINIST.

Wanted—By Cleveland firm, several capable draftsmen, expert in motor-car work; only experienced men need apply; situation permanent to the right men. Address, stating experience, age, qualifications, etc., to Box 498, AMERICAN MACHINIST.

A prominent manufacturing concern in northwestern Ohio wants to engage a machine shop foreman who is up to the minute, is experienced handling men and who can get results; applicants please give references. Box 465, AMERICAN MACHINIST.

A large motor car factory in northern Ohio desires the services of a technical man who has had experience with gasolene motor cars and engines to assist in the experimental work; work is entirely in the testing of motors and various parts of the motor car, and only those men who have had experience in this line need apply. Address, giving full experience, etc., in first letter, Box 499, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operaters, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Mechanical draftsman, experienced in high speed engine work; give full details in first letter; all communications confidential. Box 469, AMERICAN MACHINIST.

Wanted—Several strictly first-class all-around machinists, thoroughly conversant with high-class automatic engine manufacture. Valley Iron Works, Williamsport, Pa.

Wanted—Patternmaker, experienced, reliable man for medium size shop; permanent position with chance to eventually work into foremanship, for the right man. Box 470, AMERICAN MACHINIST.

Wanted—Mechanical draftsman able to design and make complete details of special boring and turning mills and other machinery. Write fully, giving experience and wages expected. Box 463, AMERICAN MACHINIST.

Draftsman Wanted—One experienced in mine pumps of all classes; location, eastern Pennsylvania; give account of experience, education, age, salary wanted and how soon can start; permanent position. Box 474, AMERICAN MACHINIST.

Wanted—Supervisor of factory production and cost estimator; must be thoroughly familiar with operation costs on light and medium heavy machinery and specialties; none but first class, experienced men need apply; give references. Apply Lycoming Foundry and Machine Co., Williamsport, Pa.

Wanted—We have positions to offer from time to time for the following lists of first-class mechanics; Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.

Foreman's assistant wanted in Philadelphia; must be experienced with tools for stamping, drawing and forming sheet steel; duties are setting dies in presses and handling a branch of press room; opportunity for a hustler, and one with ability for handling men to economically make articles from heavy sheet metal; one with bulldog stick-to-itiveness preferred; give age, experience and salary expected; answers kept in confidence. Box 494, AMERICAN MACHINIST.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

TENNESSEE

Man for die making and model making on specialty work, who is capable, handy and fast; high degree of accuracy not required; permanent job and liberal pay to a man who makes good; must be ready to come at once. Box 489, AMERICAN MACHINIST.

## Situations Wanted

*Classification indicates present address of advertiser, nothing else.*

MASSACHUSETTS

Wanted—Position by young man, experienced in handling stock ledger, and general stores department of large machine shop and manufacturing concern, to take charge of general stores department; also experienced in production work. Box 506, AMER. MACH.

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 439, AMER. MACH.

MICHIGAN

Tool designer, expert in laying out and designing tools for interchangeable manufacturing; now in charge of tool drafting room of well known automobile concern; knows by experience, how to design tools that will work right and reduce cost. Box 502, AM. M.

NEW JERSEY

Machine shop foreman, 25 years' experience in large shops, 10 years as foreman, seeking similar position. Box 509, AMER. MACH.

Turret lathe foreman desires a change; broad experience designing equipments for chucking machines, Gisholt, Jones & Lamson and Pond rigid; references A-1. Box 503, AMERICAN MACHINIST.

Let me establish and superintend a piecework system in your factory and reduce production costs, or will consider position as cost accountant, purchasing agent, factory or office manager; twenty years' experience in metal manufacturing and smelting accounting and management; now employed, but desire more congenial locality, either in the East or West. Box 505, AMER. MACHINIST.

NEW YORK

First-class draftsman, Corliss or high-speed engines, technical education, wants position. Box 511, AMERICAN MACHINIST.

Tool and die maker, expert on molds for die casting and plastic; experienced foreman and designer; executive ability. Box 490, AMERICAN MACHINIST.

Young mechanical engineer, four years' experience, desires to connect with consulting engineer in New York City; industrial engineering preferred. Box 508, AMER. MACH.

Production engineer, practical, ingenious, systematic, constructive and executive abilities, age 35, open for engagement; $2500 yearly expected. Box 935, Schenectady, N. Y.

Designing draftsman whose specialty is designing automatic machinery for making fine duplicate parts; good experience and excellent references. Box 476, AMER. MACHINIST.

Draftsman with valuable experience designing and superintending building of small automatic bench machinery, wants position where services will be appreciated. Box 477, AMERICAN MACHINIST.

Experienced foreman, middle aged, latest ideas, now employed, engineering work, dynamos and general machinery; A-1 hustler; can handle large force with ability. Box 488, AMERICAN MACHINIST.

Draftsman, young man, 24, experienced in marine engine and electrical instrument designing, desires position; practical shop man, and can act as general foreman or assistant master mechanic; good business capabilities; best of references; at present with large Eastern concern, but wish to change; not particular as to location. Box 512, AM. MA.

OHIO

Screw machine foreman having charge of large automatic and hand machine department, producing small, accurate, interchangeable work, desires change; expert tool and cam designer; location immaterial. Box 501, AMERICAN MACHINIST.

RHODE ISLAND

Steam turbine designer, 5 years in charge of experimental work, desires position. Box 504, AMERICAN MACHINIST.

WISCONSIN

Position as superintendent or foreman by experienced man in light machine manufacturing tool and special machine designing. Box 497, AMERICAN MACHINIST.

Foreman open for engagement; successful in increasing production and reducing costs of manufacturing; executive ability; expert jig designer, will go anywhere; references. Box 495, AMERICAN MACHINIST.

Superintendent or assistant desires change; resourceful mechanic and executive; now employed as superintendent; age 33, married; experienced on high-grade work, tools, jigs and dies; designer of light special tools. Box 480, AMERICAN MACHINIST.

Position wanted as a superintendent or general shop foreman in a large machinery manufacturing plant; I am 35 years of age, strictly sober and understand modern shop methods; have had lots of experience in handling men for over 14 years; understand designing Corliss engines, air compressors, ice machinery and tool and die work; will be ready to take position June 1; can give very best of references. Box 496, AM. MA.

FOREIGN

Mechanical engineer, familiar with American and English shop practice, specialist on labor reward and shop organization, seeks position in England or Scotland in sales department works or office; good executive; smart on tool design; four years general foreman, sailing May 28; age 30. Box 513, AMERICAN MACHINIST.

## FOR SALE

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; no foundry within 10 miles. Geo. H. Church, Bergen, N. Y.

Screw machines, three Hartford single spindle, can be seen running, one inch, one and one-half and two inch capacity, for sale or exchange for National-Acme multiple spindle. Warren Screw Co., Detroit, Mich.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.

# New Turn Table Lathe of Pratt & Whitney Company

## *For Machining Bar Stock, Castings and Forgings, Cheaply*

## Editorial Correspondence

A new machine tool, known as the turn-table lathe, and designed for machining bar material, castings and forgings, is illustrated by the accompanying engravings. This machine is built by the Pratt & Whitney Company, Hartford, Conn., and derives its name from the character of the tool-carrying member, which is in the form of a plain, rotary table, of hexagonal contour, providing ample space for arranging the tools without overhang.

The bearing portions of the spindle are the same size throughout, are ground and lapped, and the chuck end is finish-ground while the spindle is running in its own bearings, to insure accuracy.

The boxes are of bronze, fitting conical seats in the head, and are adjusted to compensate for wear by annular nuts at each end. The central bearing which forms an additional support at the middle of the spindle length is shown in Fig. 2, as are also the intermediate bearings for the shafts which extend through the head. The end thrust of the spindle is taken at the rear bearing by hardened-steel collars, against bronze. All the shafts in the head run in bronze bushings.

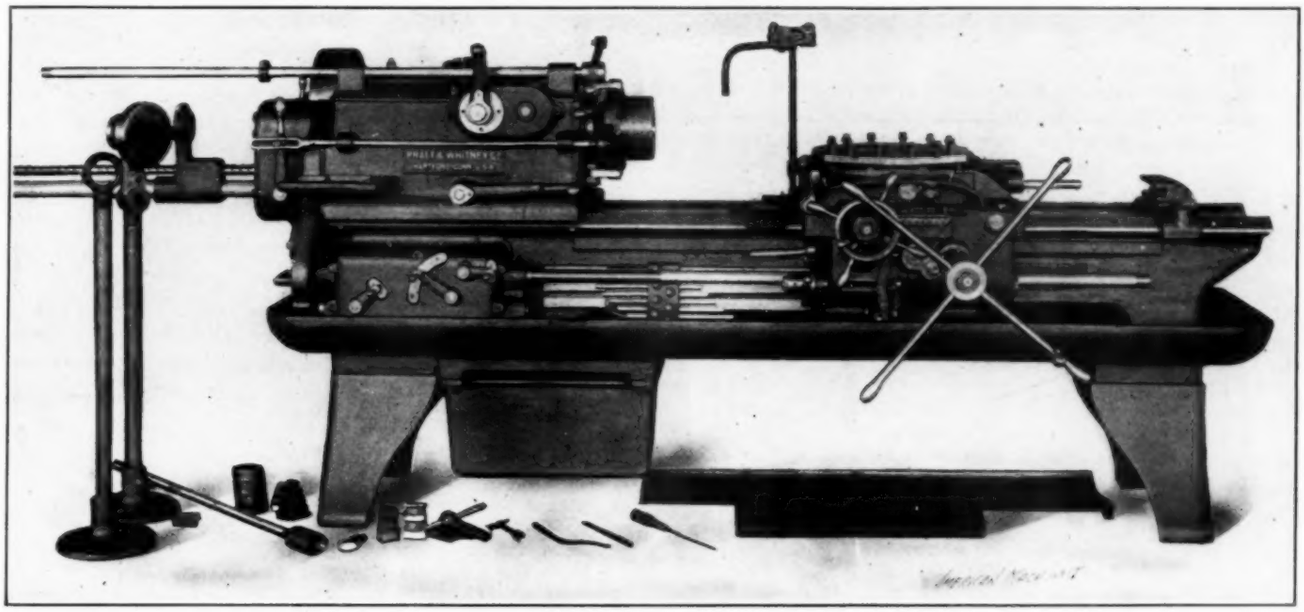


FIG. 1. THE PRATT & WHITNEY TURN-TABLE LATHE

The general appearance of the machine is well represented in Fig. 1, and various details of construction are shown in the views that follow. It has a capacity for bar stock up to 2½ inches diameter, a maximum turning length of 26 inches, swings 20 inches over the bed and 11 inches over the special forming slide.

### THE BED AND HEAD

The bed and pan are cast integrally and stiffly braced internally to insure increased rigidity and continued accuracy, and at the same time ample provision is made for taking care of lubricant and chips. The head is bolted fast to the bed, and as represented in Fig. 2, three bearings are provided for the spindle and for all full-length shafts. The head is of box construction and is oil tight, permitting the gears to run in a bath of lubricant and all of the bearings are provided with ample means for independent lubrication.

### THE SPINDLE DRIVING MECHANISM

The arrangement of the head gearing is clearly illustrated in Fig. 2. This mechanism gives eight speed changes for the spindle, ranging from 10 to 251 revolutions per minute. These are obtained instantly in the following manner: Upon the first or pulley shaft are fastened four gears of different diameters, which run at constant speed. These gears mesh with four loose, clutch-controlled gears mounted upon the second shaft, which give four speeds to the second shaft. Upon the second shaft are also fixed two gears of 6 to 1 ratio, which mesh with two loose, clutch-controlled gears on the third or spindle-driving shaft, giving eight speeds to the third shaft. A fixed pinion on the third shaft meshes directly with the large spindle gear fastened to the spindle.

The grooved cams which control the friction clutches, are so arranged that it is impossible to connect more than one set of gearing with the work spindle and driving shaft at the same time. All of the controlling levers and connections are so placed as to be conveniently operated by the workman from the front of the machine while observing the tools; furthermore, the spindle may be instantly stopped by either of the controlling levers. The reverse is obtained through the countershaft.

### THE SPINDLE CHUCK

The mechanism for automatically feeding the bar of material through the chuck and the construction of the chuck itself, are the same as illustrated in connection with the Pratt & Whitney 2½x26-inch open turret lathe, which was fully described in these columns at page 901, part 2 of our volume for 1907. It is, therefore, unnecessary to illustrate these features in detail here.

It will be recalled that the chuck jaws in this construction are supported to the extreme outer end and can be adjusted to 1/16 inch above or below the nominal size and still retain their efficiency. Special intermediate sizes are thus unnecessary, and 15 sets cover all requirements.

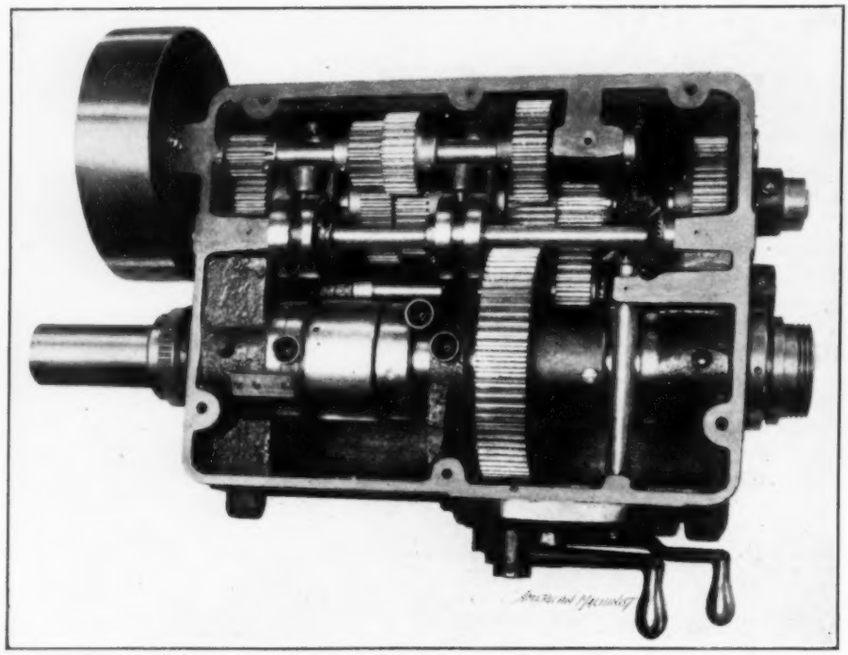


FIG. 2. INTERIOR OF HEAD

The halftone, Fig. 3, shows the chuck equipped with jaws for hexagon stock and with the spreaders in position between the jaws. Adjustment is made by turning the annular nut surrounding the closer and the jaws are removed by sliding the external operating sleeve to the left and unscrewing the adjusting nut a few turns.

The chuck is a part of, and works in conjunction with the automatic rod feed which is shown in the general view, Fig. 1.

### THE AUTOMATIC ROD FEED

When the chuck jaws are opened by the lever in front, the coarse-pitch feed screw at the end of the machine is thrown into action and advances the rod follower which feeds the stock through the chuck and against the stock stop, seen in Fig. 3. When the bar contacts with the stop it causes the follower to become stationary and the clutch which rotates the feed screw is automatically disengaged. When the rod follower has been advanced to its furthermost position, it is returned to its original position for the next bar of material by operating the short, vertical lever at the left end of the head, which engages the feed-screw clutch with a clutch gear driven in the reverse direction. The clutch is again automatically disengaged when the screw has returned the rod follower to the starting point. This rod feed handles stock of any shape,

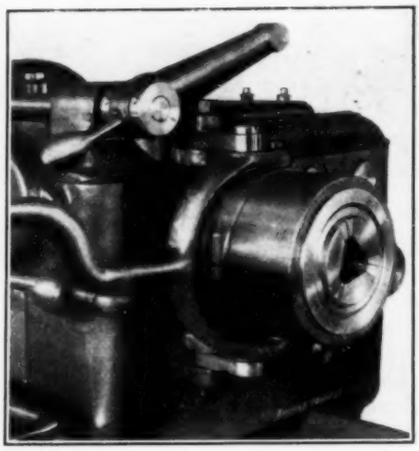


FIG. 3. AUTOMATIC CHUCK WITH JAWS AND SPREADERS FOR HEXAGON STOCK

rough or smooth. The revolving stock support shown in Fig. 1, is provided with adjustable jaws to accommodate the various shapes and sizes of materials. The stock stop consists of a stiff, swinging arm mounted on a bar which slides lengthwise in bearings formed on the head. An adjustable collar determines the forward position of the stop, and when not in use it is moved back and the stop swung up, as shown in Fig. 3, out of the way of the tools.

### THE CARRIAGE AND ITS STOPS

The carriage with its cross slide upon which the turn-table is mounted, is shown in Figs. 4 and 5, which also show the longitudinal and crosswise stops. Fig. 4 further illustrates the convenient grouping of all of the levers within easy reach of the operator.

The carriage travels upon long V-bearings of generous proportions and a taper gib extending the full length prevents

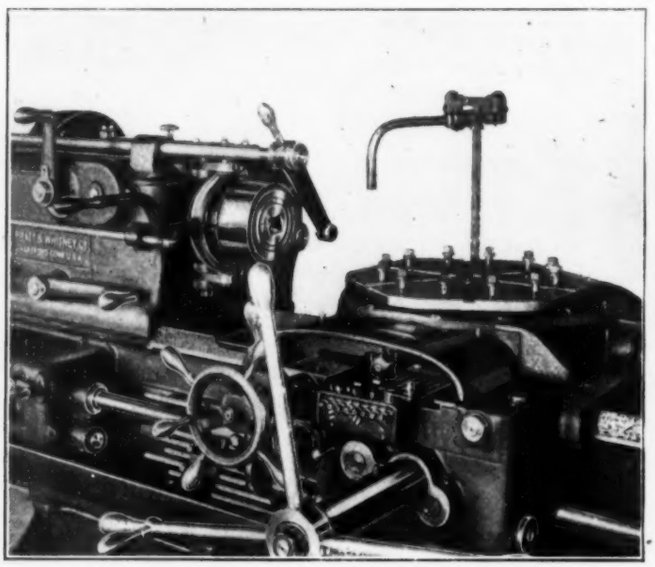


FIG. 4. TURN-TABLE AND CONVENIENT ARRANGEMENT OF OPERATING LEVERS

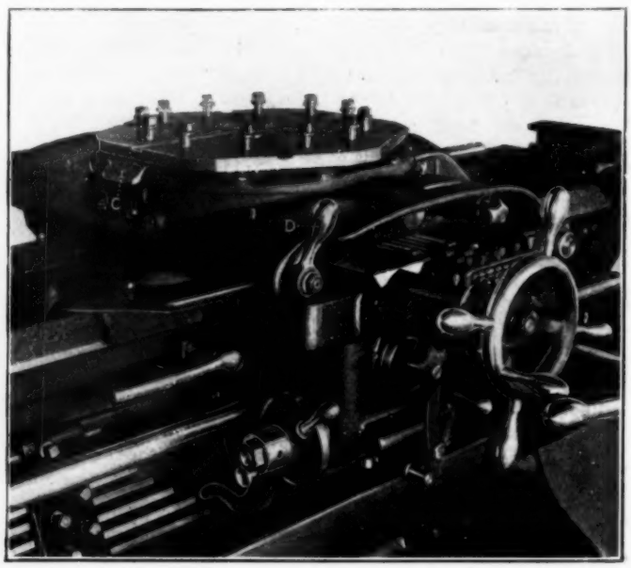


FIG. 5. TURN-TABLE AND SYSTEM OF STOPS FOR LONGITUDINAL AND CROSS FEEDS

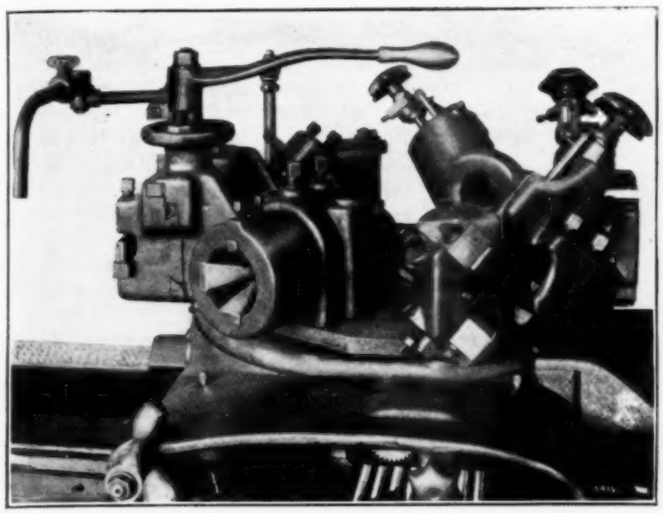


FIG. 7. TURN-TABLE WITH TOOLS FOR MACHINING BAR MATERIAL

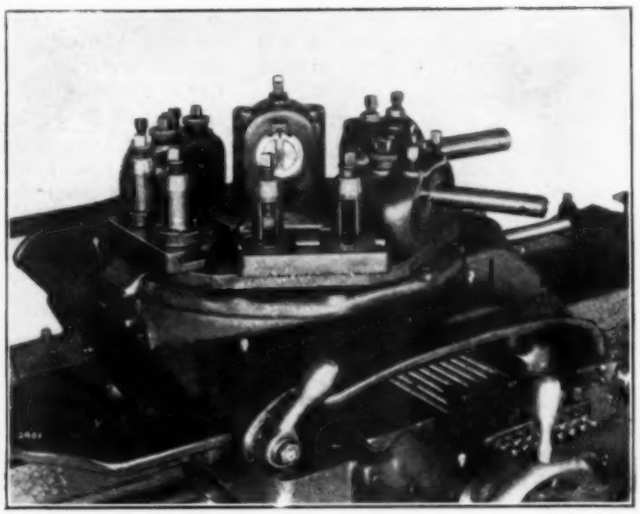


FIG. 8. TURN-TABLE WITH TOOLS FOR CASTINGS AND FORGINGS

lifting of the back of the carriage, and maintains its correct relation with the bed. A binder securely clamps the carriage to the bed during forming and cutting-off operations. The feed-gear box in front of the head is positively driven from the spindle and gives six changes in either direction, instantly obtainable by a lever which moves a sliding key. The splined feed rod transmits power through worm and spur gears supported in double bearings in the apron, the worm gearing running in oil. The rack is inverted and so placed as to be free from clogging by chips and obviate any twisting tendency on the part of the carriage.

There are six regular and three supplementary stops located in a steel bracket which may be adjusted bodily for approximate position, while the fine adjustments are secured by setting the stop rods themselves. The pressure against the stops is taken by a swinging lever operated by a cam on the lower edge of the turn-table. The stop lever is reinforced by the knock-off block and is thus rigidly supported under all conditions of operation. While using the regular stops, one for each tool, the stop lever is kept in relation with the operating cam by a lock, which, when released, allows all of the stops, both regular and supplementary, to be used in any desired combination. Thus, several stops may be used for one tool, or, special work demanding temporary use of the machine can be handled with the aid of the supplementary stops without disturbing the original setting of the regular stops.

### THE CROSS SLIDE

The cross slide by which the tools are fed across the work, particularly in machining castings and forgings, is provided with suitably proportioned bearing surface and guides upon the carriage, and is gibbed in such a position as to offset any tipping or cramping tendencies which might arise with very long boring bars or similar tools in operation. The cross slide has hand and power feed in either direction. The power feed has six changes and is governed by a friction driving device, which renders injury through carelessness or accident impossible.

Eight cross-slide stops are provided, which can be adjusted to any position and used in any desired combination. The stops are attached to the carriage directly in front and are mounted on screws, the rotation of which gives the desired adjustment. These stops arrest the movement of the cross slide by coming in contact with a stop block located in the slide. The relation of this stop block to the stops is controlled by a knob at the front of the slide, the rotation of which registers the exact position of the block. A micrometer dial is attached to the cross-feed hand wheel for accurately

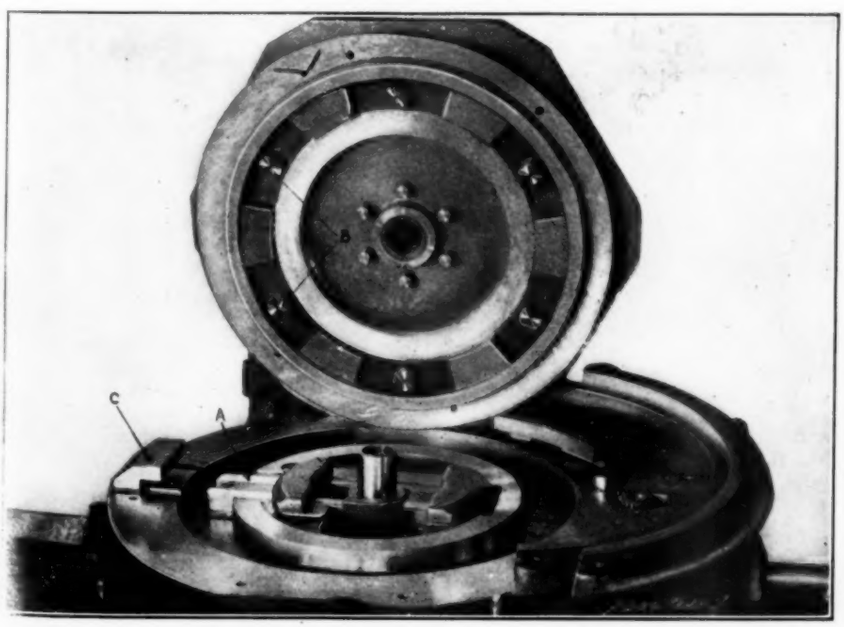



FIG. 6. INTERIOR OF TURN-TABLE

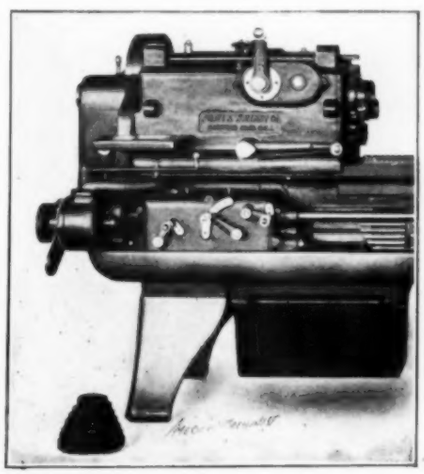


FIG. 9. THREADING ATTACHMENT ON TURN-TABLE LATHE

traversing the cross slide, also for quickly setting the stops in the desired relation to one another. A guard protects the stop from chips.

The important center relation of the turn-table with the spindle is accomplished entirely independent of the adjustable stops. The continued forward movement of the slide brings the heavy bronze nut, to which the cross-feed screw is fitted, against a stop in the carriage. The limit of travel in the forward direction is, therefore, the central position. Every precaution has been taken to finish and secure the nut and stop in a manner to assure their continued accuracy, provision, however, being made for easily adjusting the stop if found necessary.

### The Turn Table

The turn-table, with its uninterrupted tool-carrying surface, is shown clearly in Figs. 4 and 5. The interior is shown in Fig. 6 and the arrangement with complete sets of tools in position in Figs. 7 and 8.

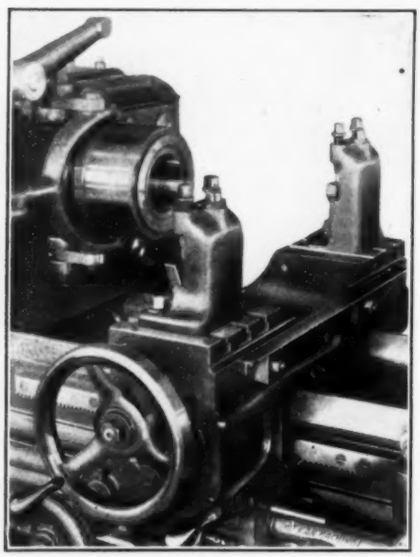


Fig. 10. Special Forming Slide

The turn-table is mounted on the cross slide and revolves about a fixed stud, hardened and ground, which fits a hardened and ground bushing stationary in the slide. A liberal bearing is provided in the slide and the turn-table is kept in contact with this bearing by means of stiff annular gibs, which are bolted solidly to the top of the slide.

The locking bolt, which is located horizontally, is of generous proportions as indicated at *A*, Fig. 6; the members engaged by the bolt will be noticed at *B*. The bolt is hardened and ground and is supported its entire length on either side by taper gibs, which allow adjustment for wear without disturbing the alinement of any other part. This adjustment can be accomplished without removing the turn-table from the slide or the tools from the turn-table. The locking bolt is also supported on top by gibs to prevent any vertical movement. It engages directly under the cutting tool in operation. The lock-bolt seats in the turn-table are also hardened and ground, to insure the continued accuracy and durability of these parts.

The rigid binding device as applied to the turn-table is shown at *C*, Figs. 5 and 6. It binds the table firmly to its seat at its outer bearing, directly under the tool in operation and does not project above the top of the table to interfere with the tool accommodation. The handle by which it is operated is seen at *D*, Fig. 5.

The index abutment stop which limits the return travel of the carriage is readily adjusted along the bed and secured by convenient binders. While the indexing of the turn-table is regularly accomplished automatically upon running the carriage back, it is also possible to rotate the turn-table directly by hand to any desired position. The indexing movement can be accomplished at all positions of the cross slide.

In the different views shown, it will be seen that the machine is well equipped for supplying oil to the cutting tools, the connection from the pump in the pan and the pipe on the carriage being by flexible tubing. The turn-table is also arranged for the internal lubrication of such tools as drills and counterbores.

Fig. 11. Tools for Castings, Forgings and Bar Stock

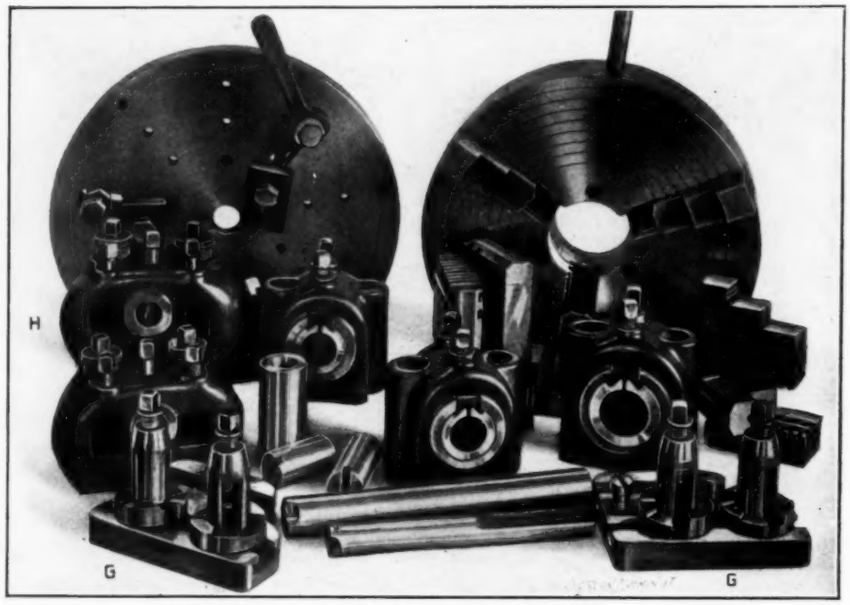



Fig. 12. Tools for Castings and Forgings

### Threading Attachment

The threading attachment as applied to the machine when required, is shown in Fig. 9. It consists of a splined lead screw, which displaces the regular feed shaft and is operated by change gearing applied as in the case of an engine lathe.

With the regular set of change gears, threads can be cut from four to twenty pitch, including 4½, 5½ and 11½ threads per inch.

When in use for threading, the screw is engaged directly by half nuts in the apron. For regular turning, the spline in the lead screw performs the same function as the replaced feed rod. The construction permits the engaging of but one feed at a time; that is, if the half nuts are engaged, the regular turning feed cannot be engaged.

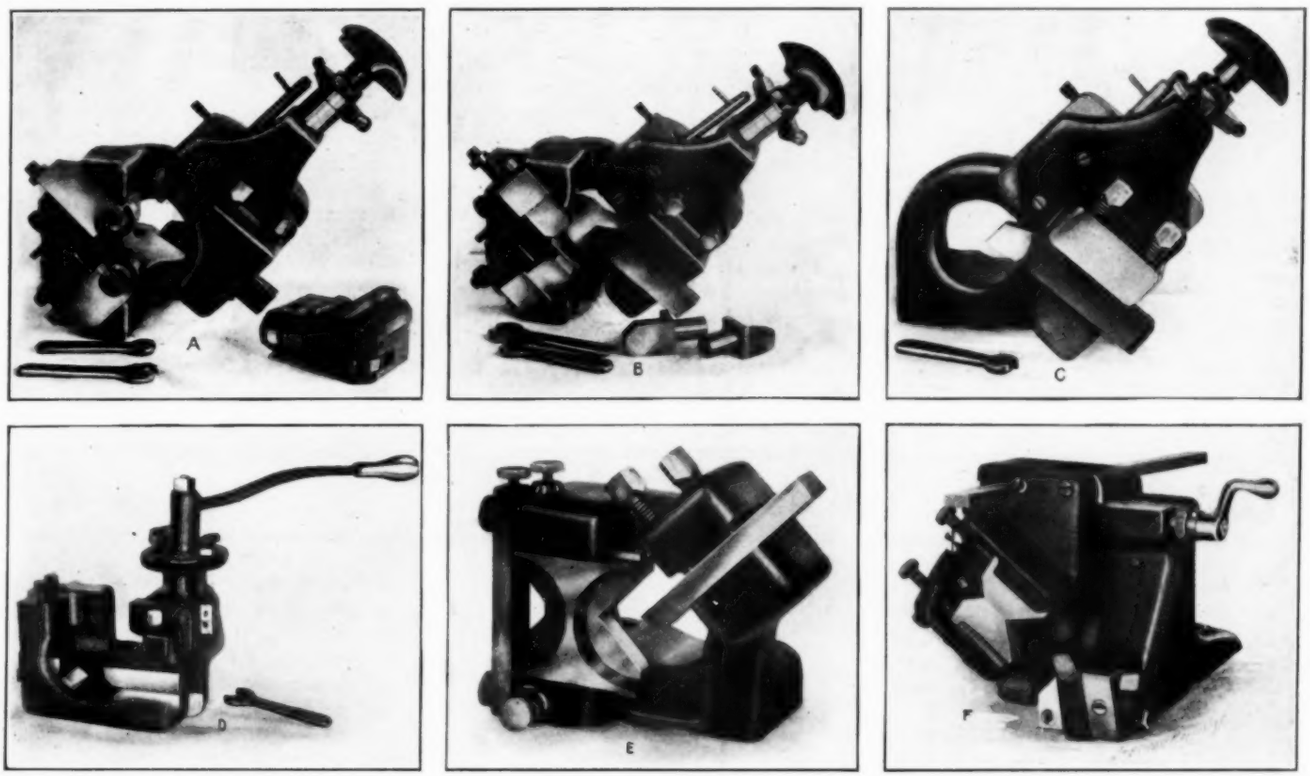



FIG. 13. UNIVERSAL TURNERS, CUTOFF, FORMING AND TAPER TURNING TOOLS

A threading-tool holder which is made for this machine, accommodates the standard threading cutters as used in the Pratt & Whitney regular thread-tool holder.

### SPECIAL FORMING SLIDE

This forming slide, as represented in Fig. 10, is mounted on the bed between the carriage and the head, and is used for heavy forming operations. It is provided with power transverse feed, which is driven directly from the feed shaft, thus giving six changes. Longitudinal feed is by hand through rack and pinion. It is provided with front and rear tool posts of an improved type. When not in use it can be moved directly under the spindle nose, so as not to interfere with the use of the turn table.

### UNIVERSAL TURNERS AND OTHER TOOLS

Two groups of tools are illustrated in Figs. 11 and 12. The former constitutes an equipment for machining castings, forgings and bar material, the latter an outfit for castings and forgings only. Several of these tools are shown more in detail in Figs. 13 and 14.

The two tools *A* and *B*, Fig. 13, are universal turners with tangent cutters and interchangeable back rests of roller and V form. As shown at *A*, the roller rests are of two types, either "leading" or "following," and the V-jaws, which are mounted in holders easily inserted in the slide, are readily reversed from leading to following. Tool *A* is used for turning either toward or away from the spindle. Turner *B* is fitted with an open side slide and is especially convenient where it is necessary to turn close to the chuck jaws, as, for example, on forged bolts.

The cutter slides of these turners have liberal radial movement for facing shoulders, for withdrawing the cutter to prevent marring of the work, and for adjusting for different diameters. An adjustable stop attached to the operating screw allows the cutter to be returned to its original position for the next turning operation. The back-rest jaws are adjusted radially by means of the screws at the rear. The universal turners are adapted for bar stock up to 2½ inches diameter. For short work of larger diameter where back rests are not required, the open-side turner *C* is adapted.

### CUT-OFF, FORMING AND TAPER TURNING TOOLS

Tool *D*, Fig 13, is a turn-table cut-off and forming tool operated by a lever, rack and pinion. The tool slide moves in a dovetail bearing and is provided with a taper gib. The lever may be moved around to any convenient position on the pinion stud and adjustable stops determine the movement of the tool slide. The tools rest on rockers for vertical adjustment and the rear tool can be inverted if desired, and used without reversing the spindle.

The end forming and pointing tool *E* is used on the ends of finished bars. Like the other turn-table tools, it is bolted directly to the table. A bell-mouth pointing tool used principally for chamfering the ends of rough stock before turning will be noticed in its holder on the turn-table in Fig. 7.

The taper-turning tool *F*, Fig. 13, is controlled by the taper bar at the top which is machined to a taper equal to one-half that required on the work. When the turn-table is fed forward, the bar strikes against a stop on the head and further movement of the turn-table then causes the taper bar to force the tool slide outward in its narrow dovetail guide in the frame of the tool, thus forming the required taper. At the same time a compensating device causes the movement of the tool slide to be communicated to the back-rest slide and the back-rest jaws are thus moved enough faster than the cutting tool to compensate for the angle of the jaws. When the jaws are set to lead instead of follow the cutting tool, the compensating lever is disconnected, the back-rest slide set to the required diameter and then clamped. The tool slide

is always held in proper contact with the taper bar by spring pressure.

### Tools for Castings and Forgings

A tool holder made entirely of steel and arranged to accommodate several tools, is illustrated in Fig. 14. The tools may be freely adjusted laterally to any desired position, and the rigid construction adapts it particularly to the holding of wide forming tools. As regularly made, the tool space is 6½x1¼ inches.

The toolpost holder shown at *G*, Fig. 12, and in position on the turn-table, Fig. 8, is of steel and provided with T-slots for receiving tool posts of the type used in the engine lathe. Vertical adjustment of the tools is provided by means of the stepped collars.

A triple tool holder for two rectangular and one round shank tool is represented at *H*, Fig. 12, and two of these holders will be seen on the turn-table in Fig. 8. This type of holder receives the regular 1⅛-inch boring bar in the equipment, and various kinds of tools can be used in the rectangular seats.

### Drill Holders, Chucks, Etc.

Fig. 12 illustrates also several round tool holders with their bushings, for die

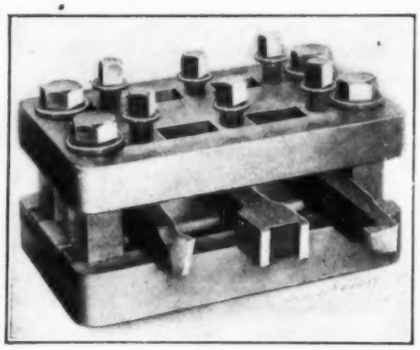


Fig. 14. Multiple Tool Holder

heads, bell-mouth pointing tools, drill and reamer adapters, etc. In the background of this view is a heavy type 15-inch gear scroll, 3-jaw chuck, for forging and casting work, and a 16-inch face plate with equipment for holding work, especially for second operations.

Among other tools of interest in this connection are taper drills and reamer adapters for shanks with Morse taper; a floating reamer holder which allows the reamer to adjust itself to the hole; a step chuck and closer with adjustable jaws, especially applicable for second operations on gear blanks, and similar work which must be finished on both sides. The reamer holder and step chuck and closer are similar in construction to the tools illustrated in the article on the 2½ x26-inch open turret lathe already referred to. Still another tool of interest is a double-end cutter bar, 3 inches in diameter by 30 inches long, which is adapted to both turning and boring operations. It is fitted with two high-speed steel cutters and suitable holding blocks.

### General Data

The spindle bearings of the turn-table lathe described in this article are 3⅝ inches diameter and the diameter of the hole through the spindle is 2⅝ inches. The driving pulley is 14x4 inches, the pulleys on the countershaft 18x4 inches. The turn-table is 18 inches across flats and the distance from top to the center of the spindle is 2½ inches.

While the machine illustrated is belt driven, it can, when required, be furnished with motor base for any standard motor. This base is cast integrally with the front pedestal, and the motor, which should be 7½ horsepower, constant speed, is belted to the driving pulley on the head.

# Tools for Square Centering Stock

*By Con Wise*

In many parts of this country square centering stock is a lost art. Most people say that it ought to be lost forever, but I believe that if properly done it is the only really correct way to do it. The objections to its use lie in its abuse.

For the sake of the many younger readers to whom the name is strange I annex the sketch, Fig. 1, which represents a crotch center and driver combined. This is usually forged to shape, roughly centered at *a* and *b* and the taper turned to fit the head spindle. The forks are then trued up by the blacksmith after about half a dozen trips between lathe and forge. It is not essential that it should run perfectly true. The tail center is the square center and is shown in Fig. 2. The angle should be carefully maintained 60 degrees at *c* and it should be made of a high grade of tool steel and hardened like a lathe tool. This is a cutting tool even if it does not look it. The stock to be centered is taken in the left hand and one end thrust in between the crotches of the head center, being careful not to put it through between the arms. The tail center is brought up sharply and "stabbed" into the end of the piece of work. The work will, of course, revolve driven by the friction of the crotch center and if the tail center is fed up it will cut a conical hole in the end of the work wherever it happens to strike. The game is to get the hole in the center.

To do it get a piece of steel, a pretty

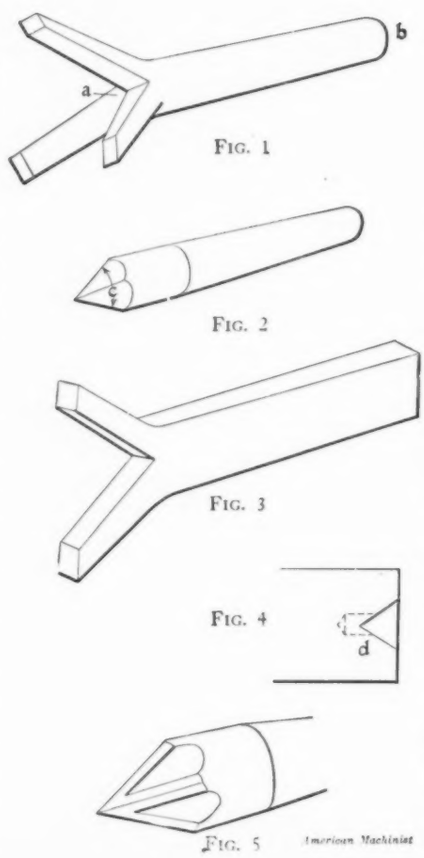



Fig. 1

Fig. 2

Fig. 3

Fig. 4

Fig. 5 *American Machinist*

Tools for Square Centering Stock

good piece too, as large as will go in the tool post. Split it in the blacksmith shop like Fig. 3. Put this in the tool post so that the center line through the fork is in line with the tail center. Now, while you are feeding up the tail spindle with the right hand feed the fork up against the work until it runs true. Then stop and take out the work. Drill with a center drill for clearance as at *d*, Fig. 4. This is just as essential as any other part of the job and is usually omitted.

If the pieces are short the best place to center drill them is in the sensitive drill. If they are long, like lead screws, do it by hand. If you are centering long shafts you, of course, have a line of center rests set up and a helper to steer the end into the crotch center. Possibly you also put on a dog to be sure that it turns around. The two essentials are the angles of the cutting edges of the square center and drilling the center hole below the countersink.

Joshua Rose, I think, proposed the form of square center shown in Fig. 5 simply to save grinding, and make it that much more likely that the man that grinds it will grind it right. As for speed, I doubt if there is any way that either short, light work or long, slender work can be so quickly centered as by this means. A man who is used to it will find that he can center as fast as he can handle the work and give about two turns to the tail screw.

# Methods Used in Babbitting Bearings

*By George Hey*

Finding that the cost of metal lining bearings was excessive, also that work was delayed by bearings wasting in the metalling department, we spent some time in getting out better appliances and improving upon the methods then in use.

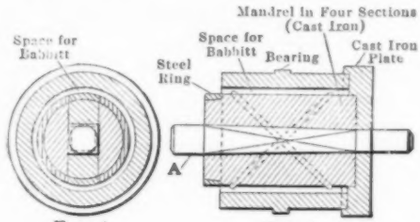



FIG. 1 FIG. 2

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A BABBITT MANDREL

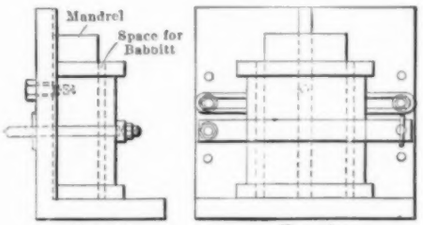


FIG. 3 FIG. 4

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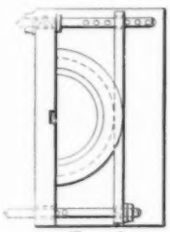

FIG. 5

BABBITTING FIXTURE FOR HALF BOXES

The result has amply repaid us for the trouble. Here are shown a few methods now in daily use that have proved great time savers. Figs. 1 and 2 show a mandrel used very much for both solid and split bearings. If the bearings are in halves a thin piece of lagging steel is inserted between the joint and butts against the mandrel. It will be seen by referring to Fig. 2 that the oil grooves are cast in the white metal. Size and shape are optional. Wire is filed, bent and fitted to the shape required and pinned on the mandrel.

These bearings are not bored, but are broached out under a mandrel press. It takes no longer to broach a bearing than to carry it to the lathe for boring, and the finish is all that can be desired. A list of broaches is here given showing sizes, amount of taper, and shape of teeth. On the 3-inch size and upward it was found necessary to use two broaches. The finishing diameter of the broach is 0.002 larger than gage, due to the babbitt springing slightly. If made gage size, the hole would be found small that amount. All the sizes given in the list are in daily use and give excellent results. When one becomes worn, it can be reduced to the next size and given a new lease of life.

When the bearing Figs. 1 and 2 has half bearings that we have in daily use.

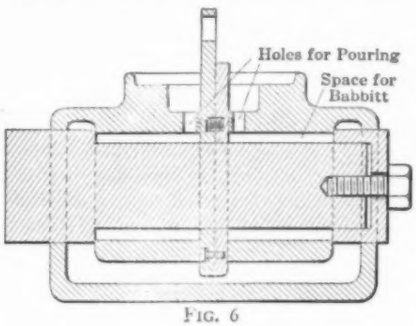


FIG. 6

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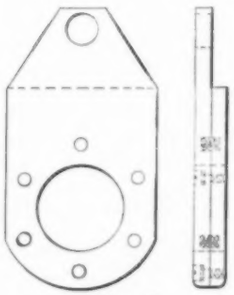
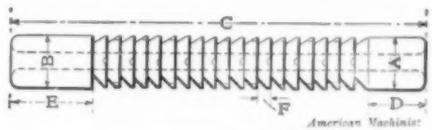


FIG. 7

BABBITTING FIXTURE FOR RING OILING TYPE BEARING

It consists of an angle plate planed on the inside square, and with a groove slotted down the center, this angle plate answering for all sizes within its range. Mandrels with spigots to fit this groove are provided, the sizes up to 4 inches being made from steel bar; sizes larger being made in cast iron. The cast-iron mandrels are simply a hollow shell and have one center rib. These mandrels are first turned, and afterward planed or milled and the spigot formed, otherwise if planed first there will not be sufficient material to hold a center. Oil grooves can be cast in these the same as in Figs. 1 and 2, two halves being clipped together for broaching. If a number of one size are going through together, U-clamps can be fixed to the angle plate as shown in Fig. 4. This does away with setting to lines.

Fig. 6 shows a method for metal lining bearings of the ring-oiler type, and has proved very successful. We have applied it to this type of bearing up to 5 inches diameter. Fig. 7 shows that part of the fixture containing the springs (the number and strength of these varying with the size of bearing). The cheeseheaded screws hold the two parts together, but allow them to open and close within certain limits. In the sketches I have not shown any method for anchoring the babbitt, although I might add that rough machining and dovetail grooves are as

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| Size. | A | B | C | D | E | F | Size. | A | B | C | D | E | F |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ¾″ | 0.735″ | 0.752″ | 6″ | 1″ | 1¼″ | ⅛″ | 2½″ | 2.488″ | 2.502″ | 12″ | 2″ | 4″ | ⅜″ |
| ⅞″ | 0.860″ | 0.877″ | 6″ | 1″ | 1¼″ | ⅛″ | 2¾″ | 2.739″ | 2.752″ | 12″ | 2″ | 4″ | ⅜″ |
| 1″ | 0.986″ | 1.002″ | 8″ | 1¼″ | 1½″ | ⅛″ | 3″ | 2.964″<br>2.996″ | 2.998″<br>3.002″ | 12″ | 2″ | 4″ | ⅜″ |
| 1¼″ | 1.112″ | 1.127″ | 8″ | 1¼″ | 1½″ | 3/16″ | 3¼″ | 3.233″<br>3.246″ | 3.249″<br>3.252″ | 14″ | 2″ | 4″ | ½″ |
| 1½″ | 1.236″ | 1.252″ | 8″ | 1¼″ | 1½″ | 3/16″ | 3½″ | 3.486″<br>3.496″ | 3.498″<br>3.502″ | 14″ | 2″ | 4″ | ½″ |
| 1⅝″ | 1.364″ | 1.377″ | 8″ | 1¼″ | 1½″ | 3/16″ | 3¾″ | 3.736″<br>3.746″ | 3.748″<br>3.752″ | 14″ | 2″ | 4″ | ½″ |
| 1¾″ | 1.488″ | 1.502″ | 10″ | 1½″ | 1¾″ | ¼″ | 4″ | 3.985″<br>3.996″ | 3.998″<br>4.002″ | 14″ | 2″ | 4″ | ⅝″ |
| 1⅞″ | 1.739″ | 1.752″ | 10″ | 1½″ | 1¾″ | ¼″ | 4¼″ | 4.236″<br>4.246″ | 4.248″<br>4.252″ | 14″ | 2″ | 4″ | ⅝″ |
| 2″ | 1.970″ | 2.002″ | 10″ | 1½″ | 1¾″ | ¼″ | 4½″ | 4.486″<br>4.496″ | 4.498″<br>4.502″ | 14″ | 2½″ | 4″ | ⅝″ |
| 2¼″ | 2.236″ | 2.252″ | 10″ | 1½″ | 1¾″ | ⅜″ | | | | | | | |

SIZES OF BROACHES FOR SOFT METAL LININGS OF JOURNAL BEARINGS.

been filled, the taper center *A* is knocked out, and the mandrel collapses. The bearing is now removed, the mandrel assembled and another bearing filled.

Figs. 3, 4 and 5 show a method for economical as any for sizes up to about 6 inches. The babbitt is an equal thickness all round the bearing and the mandrels can be better located in the ends as shown in Fig. 6.

# Tests of Another Remarkable High-speed Radial Drill

*Tables and Charts Show Results Obtained on Various Materials*

By H. M. Norris *

The article by F. E. Bocorselski, at page 479, describing drilling tests made by the American Locomotive Company is apt, I think, to create the impression that the three machines designed from C. K. Lassiter's specifications were the pioneer tools of this class.

That this is not the history of the development of the high-power radial is attested by the fact that the Bickford Drill and Tool Company, Cincinnati, Ohio, shipped from its works in January, 1909, four machines, each of which was subjected to the test of driving a 1¼-in. drill, in steel, at a speed of 310 revolutions (101.45 feet) and 0.038-inch feed. The least power consumed by this work was 18 horsepower, and the maximum 21.3 horsepower. Of the half dozen or more 1¼-inch drills of various makes submitted for trial there was not one that the machine was not capable of destroying.

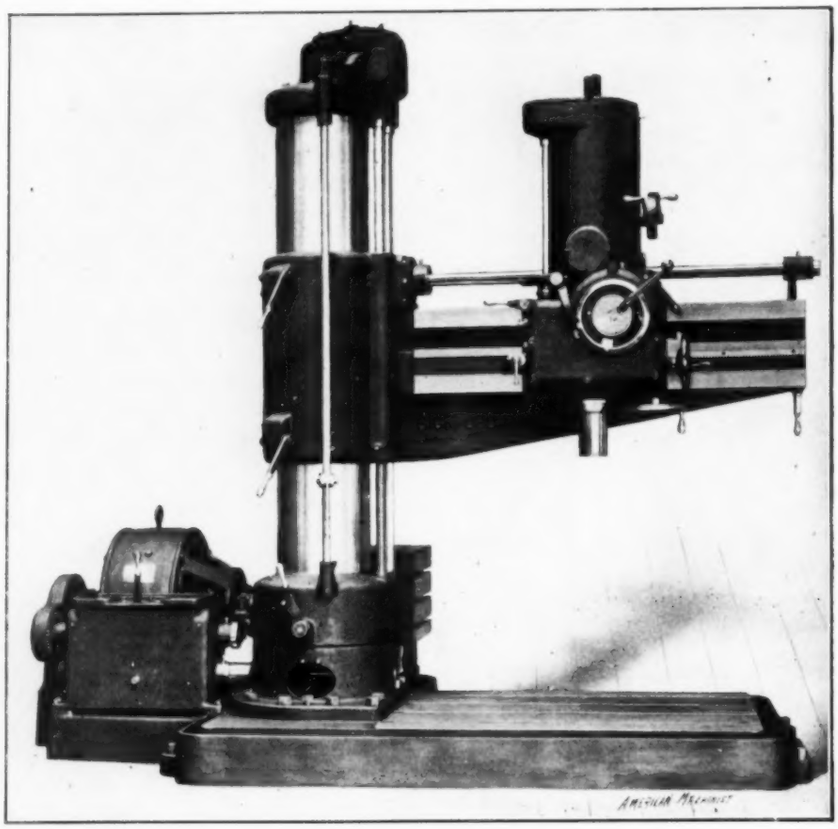

FIG. 1. BICKFORD HIGH-SPEED RADIAL DRILL

## RADIAL DRILL SPEEDS AND FEEDS

Equipped with the knowledge obtained from the tests made with these tools, the Bickford Drill and Tool Company then designed and built the radial shown in the halftone engraving, Fig. 1. It was this machine that attracted so much attention at Atlantic City in June of last year. It may be considered a more remarkable radial drill than the one illustrated by Mr. Bocorselski in that its speeds range from 38 to 519 revolutions per minute as compared with 165 to 330 revolutions; that no gear runs at a periphery speed greater than 960 feet per minute, as against 1200 feet; and that it drives a 1¼-inch drill in steel at 425 revolutions (139 feet) and 0.02-inch feed, as against 330 revolutions (108 feet) and 0.0207-inch feed, without the slightest indication that it is doing anything out of the ordinary. This gives a depth of drilled hole per minute of 8.5 inches instead of 6.83 inches, or a gain of 24.4 per cent. The material drilled was a portion of a locomotive frame furnished by the Pennsylvania Railroad Company, said to be of 55-point carbon steel.

## GENERAL REQUIREMENTS IN EVERYDAY PRACTICE

This test, together with those given in Table 1, was made at the Variety Iron Works, Cleveland, Ohio, during a demonstration of what could be expected of the machine in everyday practice. The only test made with a view to ascertaining the limit of cutting speed was with a 1¼-inch drill. This was driven at a speed of 519 revolutions (170 feet), and attained a depth of 1⅜ inches before its corners burned. If the power consumed in these tests was anything like as enormous as that consumed in some of those reported by Mr. Bocorselski, neither the machine nor the 20-horsepower motor with which it was driven betrayed the first sign of it.

The Bickford Drill and Tool Company was among those invited to quote on the radial specified by Mr. Lassiter, but it declined to do so on the ground that the tool was not adapted to the needs of the average purchaser. A minimum speed of 165 revolutions per minute permits the drilling of no holes larger than 1¾ inches at a periphery speed of less than 75 feet per minute, while a maximum speed of 330 revolutions is lower than can be used with safety for drills smaller than 1⅛ inches. Then, too, the feeds specified by Mr. Lassiter were deemed insufficient in number and too limited in range for a general-purpose machine.

## POWER CONSUMPTION CURVES

Mr. Bocorselski states that "the design of the machine only requires a single gear reduction." The Bickford radial has four changes of speed in the head but makes use of but a single reduction in driving drills at 100 feet from ¾ to 2⅝ inches in diameter. The gearing in the Bickford radial is made of 3.5 per cent. nickel steel, hardened.

| Diameter of Drill. | Revolutions per Minute. | Feet per Minute. | Feed per Revolution. | Depth per Minute. Inches. |
|---|---|---|---|---|
| 1 | 425 | 111.0 | 0.020 | 8.50 |
| 1¼ | 266 | 104.0 | 0.020 | 5.32 |
| 2 | 187 | 97.9 | 0.020 | 3.74 |
| 2½ | 132 | 86.4 | 0.015 | 1.98 |
| 3 | 107 | 84.0 | 0.015 | 1.61 |

TABLE 1. DEMONSTRATION TEST MADE ON THE BICKFORD HIGH-SPEED RADIAL.

In order to emphasize the economy of driving through as few gear reductions as possible, I give, in Fig. 2, a "curve"

*Mechanical engineer, The Cincinnati Bickford Tool Company.

showing the power consumed in driving a 3-inch drill in cast iron at various speeds and feeds. The figures on the curves indicate the feeds, those at the left the revolutions, those at the right the corresponding periphery speeds, and those at the bottom the horsepowers. In the tests represented by the two lowest plotted points, i.e., those made at the speeds of 38 and 47.5 revolutions, the power passed through three sets of reducing gears, those made at speeds ranging from 52 to 112 revolutions, through two sets of reducing gears, and those made at the speeds of 127 and 142 revolutions, through a single set of reducing gears. It will appear that, at the 0.006-inch feed, no greater power is consumed at a speed of 70 revolutions than at 47.5 revolutions, at 127 revolutions than at 84 revolutions, nor at 142 revolutions than at 98 revolutions. This very marked characteristic is true, however, at the fine feeds only, each increase in feed causing it to diminish until it disappears entirely.

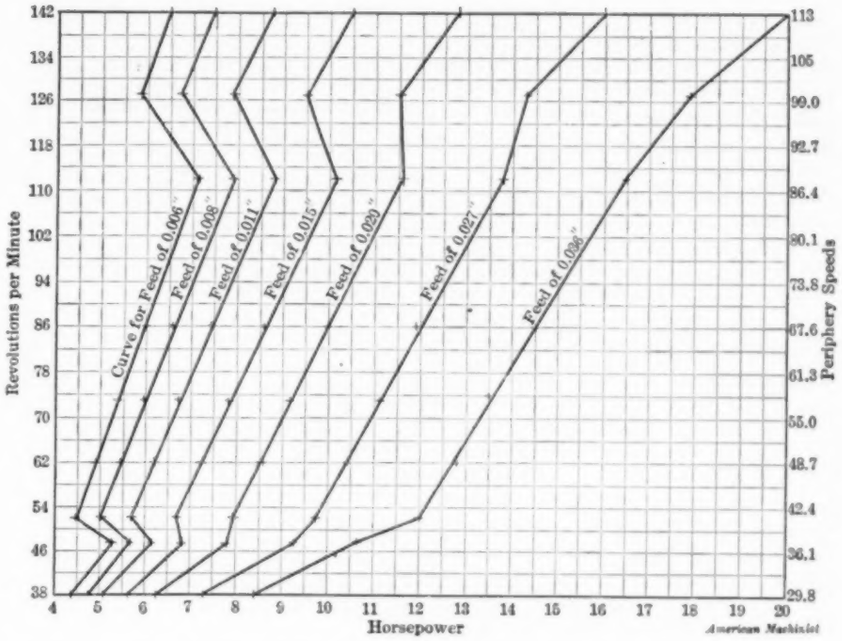


FIG. 2. POWER CONSUMED BY BICKFORD HIGH-SPEED RADIAL IN DRIVING A 3-INCH DRILL IN CAST IRON THROUGH ONE, TWO AND THREE SETS OF REDUCING GEARS

### DRILLING TESTS IN A STEEL BILLET

While the Cincinnati Bickford Tool Company, by whom the Bickford Drill and Tool Company was recently purchased, has made thousands of tests in cast iron, its knowledge of the power consumed in drilling steel with the particular machine illustrated is limited to the results shown in Table 2. Tests 13 and 16, inclusive, were suggested and witnessed by Mr. Lassiter, at Atlantic City. The material drilled was a steel billet loaned the Cincinnati Bickford Tool Company by another exhibitor to whom, I was told, it had been furnished by the American Locomotive Company. The power consumed in test No. 13 figures 6.3 horsepower per pound per minute at the 0.02-inch feed, and 5.3 horsepower per pound per minute at the 0.036-inch feed. The only other tests made in this billet are shown at 5 and 20, the horsepower consumption per pound per minute of which, at the 0.027-inch feed, figures 6.9 horsepower and 7.3 horsepower respectively.

| Test No. | Size of Drill. | Kind of Material. | Speed. Revolutions. | Speed. Feet. | Feed per Revolution. 0.006 | 0.008 | 0.011 | 0.015 | 0.020 | 0.027 | 0.036 |
|---|---|---|---|---|---|---|---|---|---|---|---|
| 1 | ¾ | Machinery steel | 286 | 56.2 | 4.52 | 4.65 | 5.27 | 5.71 | 6.75 | 8.54 | |
| 2 | ¾ | Machinery steel | 320 | 62.8 | 4.83 | 5.13 | 6.15 | 6.75 | 8.19 | 10.21* | |
| 3 | ¾ | Machinery steel | 390 | 76.6 | 5.33 | 5.91 | 6.46 | 7.58 | 9.08 | | |
| 4 | ¾ | Machinery steel | 465 | 91.3 | 5.69 | 6.46 | 8.10 | 8.88 | 10.73 | | |
| 5 | 1 | Steel billet | 266 | 69.6 | 4.5 | 5.3 | 6.0 | 7.5 | 9.0 | 11.0 | |
| 6 | 1 | Boiler plate | 266 | 69.6 | | | | 8.0 | | | |
| 7 | 1 | Locomotive frame | 266 | 69.6 | 4.5 | 5.5 | 7.5 | 9.5 | 12.0 | 17.0 | 20.2† |
| 8 | 1¼ | Machinery steel | 124 | 40.5 | | | 4.50 | 5.19 | 6.00 | 7.31 | |
| 9 | 1¼ | Machinery steel | 142 | 46.5 | | | 5.06 | 6.00 | 6.87 | 8.37 | |
| 10 | 1¼ | Machinery steel | 170 | 55.6 | | | 5.75 | 6.75 | 8.06 | 9.88 | |
| 11 | 1¼ | Machinery steel | 202 | 66.1 | | | 6.50 | 7.87 | 9.50 | 11.75 | |
| 12 | 1¼ | Machinery steel | 245 | 80.2 | | | 7.62 | 9.25 | 11.25 | 14.25 | |
| 13 | 1¼ | Steel billet (wet) | 300 | 98.2 | | | | | 13.0 | | 19.8 |
| 14 | 1¼ | Steel billet (wet) | 300 | 98.2 | | | | | 13.3 | | |
| 15 | 1¼ | Steel billet (dry) | 300 | 98.2 | | | | | 15.5 | | |
| 16 | 1¼ | Steel billet (dry) | 300 | 98.2 | | | | | 18.0 | | |
| 17 | 1½ | Machinery steel | 127 | 49.9 | 5.10 | 5.85 | 6.65 | 7.73 | 8.96 | 11.79 | |
| 18 | 1½ | Machinery steel | 142 | 55.8 | 5.23 | 5.66 | 6.63 | 7.58 | 8.50 | 11.04 | |
| 19 | 1½ | Machinery steel | 167 | 65.6 | 5.50 | 5.96 | 7.1 | 8.40 | 10.13 | 12.70 | |
| 20 | 1½ | Steel billet | 187 | 73.4 | 6.5 | 7.1 | 9.0 | 11.5 | 15.0 | 18.5 | |
| 21 | 1½ | Machinery steel | 195 | 76.6 | 6.52 | 7.10 | 8.04 | 9.56 | 11.71 | 14.77 | |
| 22 | 1½ | Machinery steel | 250 | 98.2 | 8.13 | 8.91 | 10.0 | 12.31 | 15.0 | 17.75* | |
| 23 | 2 | Locomotive frame | 132 | 69.1 | | | | | | 23.0 | |
| 24 | 2 | Locomotive frame | 187 | 97.9 | | | | 16.0 | | | |
| 25 | 2 | Locomotive frame | 235 | 123.0 | | 11.0 | 13.5 | | | | |
| 26 | 2 | Locomotive frame | 235 | 123.0 | | | 15.0 | 18.5 | | | |
| 27 | 2 | Locomotive frame | 266 | 139.2 | | 12.5 | | | | | |
| 28 | 2 | Locomotive frame | 300 | 157 | | 16.5 | | | | | |
| 29 | 3 | Boiler plate | 71.6 | 56.2 | | | 12.5 | | | | |
| 30 | 3 | Locomotive frame | 84.8 | 66.6 | | | | | 17.0 | | |
| 31 | 3 | Locomotive frame | 84.8 | 66.6 | | | | | 17.5 | | |
| 32 | 3 | Boiler plate | 84.8 | 66.6 | | | | 15.5 | 20.5 | | |
| 33 | 3 | Boiler plate | 84.8 | 66.6 | | | | 17.0 | | | |
| 34 | 3 | Boiler plate | 107 | 84.0 | | | | 15.5 | | | |
| 35 | 3 | Boiler plate | 107 | 84.0 | | | | 16.5 | | | |
| 36 | 3 | Boiler plate | 107 | 84.0 | | | | 18.5 | | | |

*Drill broke. †Drill burned.

TABLE 2. POWER CONSUMED IN DRIVING DRILLS OF VARIOUS DIAMETERS AT VARIOUS SPEEDS AND FEEDS.

| Speed. Revolutions. | Speed. Feet. | Feed per Revolution. 0.011" | 0.015" | 0.020" | 0.027" |
|---|---|---|---|---|---|
| 124 | 40.54 | 9.49 | 8.03 | 6.97 | 6.28 |
| 142 | 46.45 | 9.33 | 8.11 | 6.96 | 6.22 |
| 170 | 55.60 | 8.86 | 7.62 | 6.83 | 6.21 |
| 202 | 66.10 | 8.43 | 7.49 | 6.77 | 6.21 |
| 245 | 80.19 | 8.15 | 7.22 | 6.61 | 6.20 |

TABLE 3. POWER CONSUMED PER POUND PER MINUTE OF METAL REMOVED IN DRIVING A 1¼" DRILL IN MACHINERY STEEL AT VARIOUS SPEEDS AND FEEDS.

### MACHINE STEEL DRILLING TESTS

The tests in machinery steel are more comprehensive, as the values given are based on the results obtained from five trials at each speed and feed. A plot of those made with the 1¼-inch drill is shown in Fig. 3. It will be observed that the power consumed, as represented by the plotted points, follows the linear law expressed by the straight lines drawn in accordance with the equation:

$$H.P. = 1.975\,(f + 0.0021)\left[r + 0.00867\left(\frac{100}{f} - 3323\right)\right].$$

Figured by this formula, the power required to drive a 1¼-inch drill in machinery steel at 300 revolutions and 0.02-

inch feed would be 13.73 horsepower. This is within a half horsepower of that consumed in test No. 14, which indicates that the same expression might be applicable to both materials. As the scale on the Westinghouse graphic recording wattmeter used in these tests reads to 24 horsepower only, it was necessary to limit the trials to this figure.

### Effect of Speed and Feed Advance on Power Consumption

After stating that the cutting speed in feet per minute in Table 1, of his article, averages higher than in either of the others, Mr. Bocorselski says he will leave it to the reader to judge "how much the effect of this higher cutting speed has to do with the lower power required per pound of metal removed." The tests made on the Bickford radial show that the power per pound of metal removed decreases very slowly as the speed is advanced, as compared with the reduction effected through increasing the feed. Take, for instance, the results obtained with the 1¼-inch drill, Table 2. It will be seen, by referring to Table 3, that the power per pound of metal removed decreases less than half as rapidly one way as the other. Doubling the speed, that is, running at 248 revolutions instead of at 124 revolutions, effects, at the 0.011-inch feed, a saving in power per pound of metal removed of 14.2 per cent., while doubling the feed, that is, advancing the drill 0.022 inch per revolution, instead of 0.011 inch, effects at the speed of 124 revolutions a saving of 28.7 per cent., or more than 2 to 1.

### Best Speeds and Feeds for Drills

In concluding his article, Mr. Bocorselski says: "For the maximum production and considering the life of drills at the same time, it seems best to run a 1-inch drill about 300 revolutions per minute with a feed of 0.015 inch per revolution; a 1½-inch drill at 225 revolutions per minute at a feed of 0.02 inch per revolution." The tests made on the Bickford radial indicate that drills of the twisted type from 1 to 2 inches in diameter may be operated in steel of 55-point carbon at a cutting speed of at least 100 feet and 0.02-inch feed without more than ordinary dulling. This gives a depth of drilled hole per minute of 7.64 inches, as against 4.5 inches with a 1-inch drill, and 5.1 inches as against 4.5 inches with a 1½-inch drill.

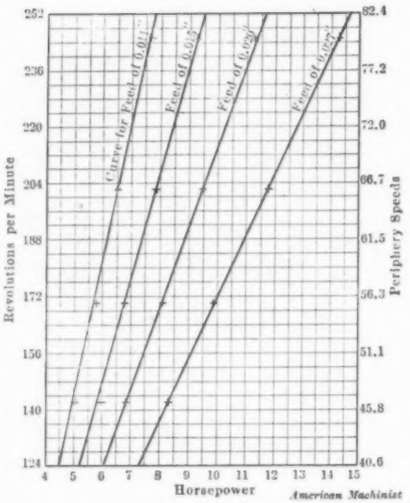


Fig. 3. Power Consumed by Bickford High-speed Radial in Driving 1¼-inch Drill in Machinery Steel at Various Speeds and Feeds

### Machine Efficiency

The efficiency of a machine does not, however, depend upon its speeds, feeds, rigidity and power alone, for unless these characteristics are combined with durability and ease of manipulation little is gained in the aggregate. A 1¼-inch drill operating at a speed of 100 feet and 0.02-inch feed consumes less than 24 seconds in passing through a 2-inch plate, while if the machine is not easily handled many times 24 seconds may be required to swing the arm and bring the head into position for drilling the next hole. The arm and head on the Bickford radial are moved quite as easily as on a machine of half its weight. The head is gibbed to the arm on the principle of a boring-machine head and may be pulled from one end of the arm to the other without resorting to the hand wheel.

### Other Features

Other distinctive features lie in the base which is strengthened by two deep box-section ribs and contains a reservoir and channels for the use of a lubricant. All the gearing is completely incased not only to afford protection to the gear and operator but also in order to shield the operator from flying oil. Mention should also be made of the fact that the gearing is arranged so that the operator can obtain a speed of approximately 30, 35, 40, 45, 50, 60, 70, 80, 90 and 100 feet per minute for any diameter of drill from ¾ to 3 inches. The chief advantage of this is that it enables the foreman to issue definite orders as to the cutting speeds to be used in drilling metals of different degrees of hardness. Forty feet may be excessive for some grades of chrome-nickel steel, while other steels can be drilled with safety at 125 feet. There was a time that the radial-drill builder hesitated about recommending driving a 3-inch drill in steel faster than 13 revolutions and 0.007-inch feed, while now one need have no misgivings about anything under 100 revolutions and 0.015-inch feed. The gain in depth of drilled hole per minute is over 16 to 1.

### Future Tests

The Cincinnati Bickford Tool Company will soon have completed six more of these machines with which it intends to make a sufficient number of tests to ascertain the relative power consumed in drilling steels of various carbon content. Further information is also desired on the law pertaining to the relative power consumed by drills of various diameters.

# Placing Concrete in Freezing Weather

*By D. C. Giles*

Although I have done considerable in concrete construction, it has been a matter of considerable speculation with me as to its advisability in real cold weather. This last fall our company decided to build a new plant, and have it ready for spring operation. It was to be of concrete blocks with a boiler house adjoining of solid concrete, and a solid concrete reinforced boiler setting.

The early part of the fall, as readers living in New York State will recall, was nice and work was rushed. About the time that the forms were up for the boiler setting, however, it began to get colder, ranging from 15 to 20 degrees at night. The lower three feet of both setting and boiler room was placed when the temperature was no lower than 15 degrees, but the afternoon that the forms were filled from this three-foot level to nine feet above grade it got rapidly cold, and by 10 o'clock that night was 11 below zero. It remained cold for nearly a week, freezing the concrete through and through. After it moderated, the remaining portion was filled and the block work continued on part of it above. We didn't "bank" much on this part coming through successfully, and were prepared to shore up and carry the portion resting on it and replace the concrete placed during the zero weather, if necessary.

When the warm weather of spring came, however, the walls were apparently all right. We warmed the boiler up gradually, and it is now worked right along. The walls are a very little softer than normal, but are hardening apparently and so far no cracks have appeared.

The mixture used was one part cement to four and one-half parts sand and gravel, natural mixture. This natural mixture contains a little too much fine sand to be of the best.

This was machine mixed using sa[illegible] exact proportion hard to determine b[illegible] about five pounds per barrel. Water w[illegible] not warmed for this part of the wor[illegible] Forms were made of plank and no pr[illegible]

tection given the work other than the forms. The whole job was in a location very much exposed and subject to winds, and at the time this part was put in the other portions of the building were no further along, hence there was no protection from this source.

This experience has convinced me that concrete work can be successfully put in in zero weather or colder, and I am giving the experience for what it may be worth to others who may, perhaps, be compelled to do work under similar unfavorable conditions and have misgivings in attempting it.

# More Light on the Hindley Worm Gear

*By David Brown*

The principal advantage of the Hindley over the straight worm is the higher efficiency obtained from its use. First, we are able to give a much greater depth of tooth, owing to the fact that every tooth in the worm points toward the center of the wheel, thus doing away with interference at the ends of the worm. Secondly, we are enabled to secure a full surface bearing on the center thread and to a less extent on the full length of the worm.

On the straight worm gear the common depth of tooth is 0.686 of the pitch, while in the Hindley worm we can make the depth of tooth equal to the pitch. Thus the load is distributed over a greater bearing surface and there is less tendency to squeeze the oil from between the engaging teeth, thereby securing better lubrication.

## Cutting

The wheel is cut on a machine which has two spindles at right angles; one spindle being mounted on a movable table. The wheel is cut by a hob, which is a duplicate of the worm to be used. The spindle on which the hob is placed is driven by a cone pulley, with back gears to increase the power according to the diameter of the hob. The other spindle carrying the blank wound wheel is driven by a worm and wheel, which is in turn driven by change gears from the hob spindle according to the ratio of the gears to be cut. For Hindley gears it is absolutely necessary that the wheel should be positively driven. It cannot be driven by the hob, as is often done for straight worm gears.

There are two methods used in cutting the Hindley worm. In the first method we can use the same machine that is used in cutting the wheel. In this method we place the blank worm on the spindle in place of the hob, and on the other spindle in place of the wheel we place a cutter head with cutters inserted to represent the teeth in the wheel. The number of cutters varies according to the conditions. For instance, for a single thread worm we would use one-half as many cutters as there are teeth in the wheel, but in case of a double thread to engage a wheel with, say, 50 teeth, we would make the cutter head of a suitable size for 51 teeth and then insert a cutter for every third tooth instead of every second tooth. This would give us 17 cutters, and for every two revolutions of the cutter head each cutter would have passed through both threads of the worm. The cutters are set to the same diameter as the wheel and when the machine is started the cutter head is fed automatically toward the worm until the required depth of tooth is obtained. The cutter head is then drawn back from the worm and the cutters are set out to a larger diameter to cut a clearance on the ends of the form, and fed in as before.

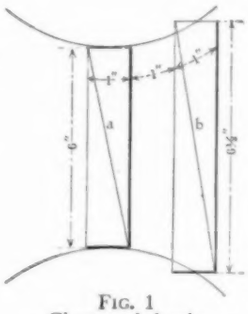


Fig. 1 Change of Angle in the Worm Thread.

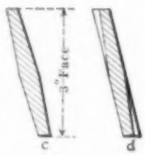


Fig. 2 Clearance in the Teeth of Worm Wheel.

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The other system of cutting the Hindley worm is by an end mill. The end mill is mounted on a revolving table, which takes the place of the cutter head used in the first system, so arranged as to feed out from the center of the table. The connection between the two spindles is made in the same manner as for the first system.

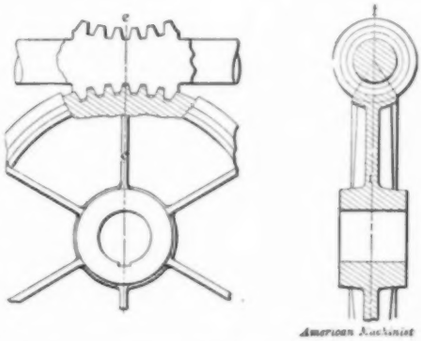

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Fig. 3. Positions To Be Maintained in Assembled Gears

When cutting the worm the distance between the center of the table and the center of the worm is made equal to the center distance of the finished gears. The end mill is first fed forward on the table until it touches the worm blank, the table is then revolved until the end mill comes to the end of the worm, the end mill is then fed forward the depth of the tooth; the position of the table carrying the mill not being changed. The gearing driving the table is then connected to the worm shaft driving the spindle and a cut is taken through the worm. In cases of more than a single-threaded worm it is necessary to run the machine back and by means of an index revolve the worm a sufficient amount to cut the next thread and so proceed until all the threads are cut.

After the worm is cut to the proper depth the table is drawn back from the worm and the mill is moved forward a sufficient distance to cut the clearance in the ends of the worms. This is practically the same as setting out the cutters in the cutter head in the first method.

## Advantages of Different Systems

Each system of cutting has its advantages. In the system using a cutter head, one cutter following another in rapid succession, there are always two, and sometimes three cutters cutting at the same time, and a coarse feed can be used; also the work can be done in less than one-half the time of the second system, and when a number of the same size gears are to be made this is much the cheapest method. But in case there is only one or two sets of a size the cost of the cutter head makes the first system the most expensive, as a cutter head could not be used for a larger wheel and for only two or three teeth smaller.

In the second system the same end mill will cut a worm to fit almost any size wheel of the same pitch, and though it takes longer to do the work it is cheaper in the end for a small quantity.

## Clearance

In cutting the Hindley worm it is necessary to cut clearance in the worm, and also the same clearance in the hob. The worm being cut on the same radius as the wheel it will be larger in diameter on the ends than it is in the center and, as the lead is the same at all points the angle of the lead will be constantly changing and become less as we approach the ends of the worm. Now, if no clearance was cut in the hob we would have a very defective tooth in the wheel. For example take a worm 6 inches in diameter and a lead of 2 inches, Fig. 1. In the center tooth of the worm, we would have angle *a* and on the ends of the worm angle *b*. Now if no clearance were cut in the hob we would have a tooth like *c*, Fig. 2, which would not give a sur-

face bearing at the center of the worm of more than one-half of the tooth, the clear spaces shown in *d* having been cut off by the ends of the hob. So in order to make a perfect tooth in the wheel we must cut enough clearance in the hob and worm to clear the spaces shown in *d*.

ERECTING

It will be readily seen that it is important that the worm and wheel be set central both ways as at *e* and *f*, Fig. 3; also, that the worm should be held to its place, for if the worm is allowed to move endwise we not only destroy the surface bearing of the tooth but cause one end of the worm to bear on the top of the teeth of wheel, thereby causing much loss of power through increased friction.

LENGTH OF THE WORM

Owing to the clearance in the worm, the teeth at the ends are thinner than in the center; for this reason, also owing to the fact that the end teeth would be undercut, the length of the worm should never be more than one-third of the diameter of the wheel, and in case of coarse leads not as long as that. The face of the wheel at the root of tooth should never, under any circumstances, be more than one-half of the diameter of the worm at center.

# Foundry Course for Engineering Students *By J. R. McConnell**

In order that a student who is beginning a college course in engineering may become properly fitted for his work later in the course, he must receive a great many lessons composed of the bare fundamentals. If he is to design machinery, he must not only know how to design for strength, economy, appearance, etc., but he must know how the part is to be machined, how the pattern has to be made, and further, he must know something of the foundry side.

In a great many engineering schools, I have noticed that this phase of the young engineer's training is more often neglected. At least one is led to judge so from the appearance of the foundry room. This department in some cases looks like a general "dump" for the others. The place is dark and gloomy, the floor is rough and dusty, flasks and equipment may be found in most any sort of bad condition, and the cupola appears to have exploded at the last run. These untidy conditions, coupled with a great many others, usually have the effect of causing the student to form the opinion that a course in the foundry is a mere waste of time, and we cannot but agree with him.

But there is the other, the optimistic side. With a bright, cheery room, clean windows and a well kept floor, smooth and free from dust, neatly shaped ridges of sand, rows of benches with their individual kits of tools, all properly arranged with nothing broken or missing, everything ready to be used, a pattern room with its well planned collection of patterns, all shellacked and ready for distribution, and a cupola clean and unscarred, simply waiting to have the charge inserted. Show this kind of a foundry to the prospective engineer, and he will have no grounds for forming an adverse opinion as to whether the course in the foundry is time wasted or not.

With a suitable foundry and an equipment worthy of the name, allow us to size up our instructional corps. In the average institution, two men are necessary to promote the work satisfactorily. One of these should be a foundry-man with foundry experience, the other a technical college graduate, who has had the experience of being taught. These two men should then unite, agree upon a suitable campaign and follow it. They will teach each other, will combine practice with theory and in turn be able to give the student the highest class of instruction.

Upon his first appearance the student should be taught how to cut, moisten and riddle the sand and to make a mold using a simple pattern. Then allow him to try for himself. At first he will ram the sand too much or too little, he will forget to use the vent wire, but after several trials he will begin to acquire the necessary skill.

At the close of each period, great care should be exercised on the part of the instructor in charge to see that the students clean up the shop properly. The benches and tools must be left clean and in place, the floor must be swept and the sand piled in long even ridges. Here is an excellent place to teach the beginner that slipshod methods will not do.

During the preliminary practice the molds are criticized and the defects pointed out to the student. As to its length, authorities differ, but it has been my experience that three weeks of eight hours each should be the minimum length. This gives the student a chance to do a great many exercises and hence cover a great variety of patterns.

The next three weeks should be spent in preparing molds which are to be poured. During this time he can be placed at the core bench, can help charge the cupola and make all necessary arrangements for the run. The stronger and steadier ones should be assigned to the ladles, while the others may be appointed to positions as skimmers and of general utility. Here again is where the most rigid rules of discipline must be outlined and enforced as a burned foot due to some careless prank is utterly intolerable.

As an aid to the instructor and student as well, a "job assignment sheet" should be posted previous to each exercise in order that the work can begin without delay. The function of this sheet is to assign the pattern to a certain group of men. About three men can work on a floor piece of moderate dimensions to good advantage.

During the term of practice, short lectures should be given from time to time. In this way the instructor can present many items that the wide awake student will grasp and retain. As a finale to this course, the student should be given a written examination which should cover the course in a thorough way.

It has been the result of experience that after our embryo engineer has finished the course in molding as only briefly outlined above, coupled with the rigid disciplinary requirements connected therewith, he will be a much improved and more capable subject to absorb the principles of engineering, which are to follow.

*Instructor, Worcester Polytechnic Institute.

## Forest Products Laboratory

At the University of Wisconsin, the building set aside for experimental work in wood preservation, and which has been equipped by the Department of Agriculture, is now ready for work.

The object of the work is to make tests of strength and other properties of wood; to investigate the processes of treating timber for preservation; the utilization of wood refuse by distillation processes; and to determine the availability of the fibers for paper and other purposes. Thirty-five or forty persons will be employed in engineering, and other positions, by the Department of Agriculture, to carry on the work at the laboratory.

In a paper dealing with steel-foundry practice presented to the Manchester Association of Engineers, attention is called to the fact that shrinkage and contraction are terms often used loosely. Technically, shrinkage refers to the gradual lessening in volume of fluid metal as it approaches the solidification point at which shrinkage ceases and contraction commences, contraction being understood to refer to the lessening in length or in volume of the solid metal.

# Steel in Car Construction

*Special Correspondence*

The present increasing traffic plus the demand for greater speed in traveling has caused the railroad companies to look around for something more substantial and more fire-resisting than the present wooden coaches. Naturally they turn to

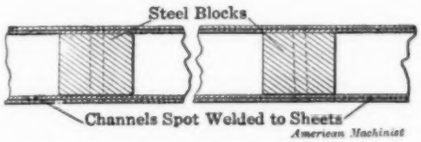



FIG. 1. CLIPS WELDED TO SHEETS

metal; but being so much heavier than wood, the demand is for a construction that will withstand shock and twisting, and yet be light in weight.

This difficulty has been overcome in many ways by a Philadelphia firm that is building a large number of cars for three large railroad companies operating in the east and west; also for a company operating their cars over all roads.

Electric and acetylene welding are playing a very large part in this work.

The bodies of these cars are constructed mainly of a structural work of I-beams, T-irons, etc., on the outside of which is placed sheet steel of about ⅛ inch thickness, with 0.050 inch metal for interior finish. The inner partitions, door and window frames, curtain housings, berths and seat frames are all made from metal varying from 0.040 to 0.080 inch in thickness.

### PREPARING SHEETS

A great portion of this work is done by stamping, and requires dies of large proportions.

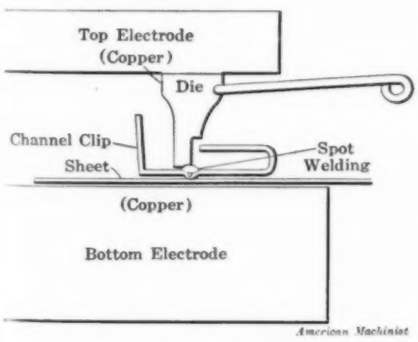



FIG. 2. READY TO SPOT WELD

In this article we will treat mainly on the construction method of partitions, which are assembled in the following manner:

After carefully selecting the sheets, looking out for buckles or lumps, they are sent to the shears to be cut and squared up to size. Some of these sheets are then sent to the stamping or press department, while others are delivered to the construction department to be laid out for any cut-outs or miters that may be necessary. These cut-outs and miters are cut on small hand shears or chiseled out. The sheets are then ready for welding, which is a very interesting part of the construction.

These partitions are very similar to the partitions of a house. The studs are made of channels, held in place by clips that are welded to the sheets, as shown in Fig. 1. The method used being electric spot welding; the operation of which is shown in Fig. 2.

### WELDING ON ACCESSORIES

After welding on all clips, tapping strips, and molding clips, these sheets are returned for a coat of lead paint on the inside. The channels are then driven into the clips, thus forming a solid body about ¾ of an inch thick. This leaves nothing but the ends and sides to be finished. These are also finished with channels. They are about 0.66 inch in width, the

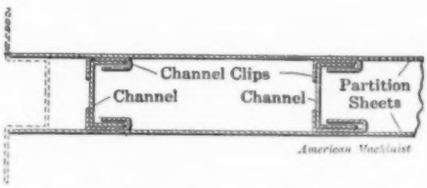



FIG. 3. WELDING IN STEEL BLOCKS

side channels having small blocks 7/16x 9/16x¾ inch in size as shown in Fig. 3. These blocks are set about 6 inches apart and are for the purpose of making a solid body through which rivets can be driven when the sections are put together, or when sections are joined to door frames. These channels are held in place by small clamps until they are electric welded to the sheets.

The number of tapping strips and riveting plates depends on the location of the partitions in the car, some have fastened to them water coolers, mirrors, wash bowls, shelves, dressers, telegraph blank boxes, and all such requirements of an uptodate car.

The molding for these cars is all drawn through dies of the proper shape and is used for a double purpose. It hides the joints of the upper and lower sections, as in Fig. 5, and adds to the finish of the car. It is held in place by a small clip, or off-set strip, which is electric welded to the sheets.

### MAKING PARTITIONS

There are a number of ways of making these partitions or bulkheads. A great deal of attention is paid to the amount of strain this work will stand and yet be as light in weight as possible. One of the latest methods of making the doors and bulkheads is to leave out the channel clips and run the channels the full length of the work, instead of the width. A great saving of time is made in this way, due to the fact that one operation only is re-

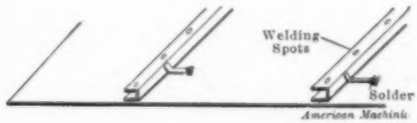



FIG. 4. LOCATING CHANNELS WITH SOLDER

quired to weld the inner channels to both sheets.

These channels are spotted by a power punch, the spots being about 5 inches apart. They are held in place on one sheet by a drop of solder here and there until the welding is done, as shown in Fig. 4. The channels are of 0.050 inch metal and 0.660 inch wide.

During the welding of this channel to the sheets, a mandrel 0.550 in width is placed in the channel as a support to the same when the pressure of the electrodes comes on it at the instant of welding. Quite an interesting part of this operation is the fact that the square mandrel inside the channel does not fuse to the metal in welding. The fusing only takes place at the points of spotting, even though the spots become a white heat. This is considered a freak of the electric current, and a very lucky one for the manufacturer. We believe this action is due to the resisting power of the bar to the heat, and to the metal that is welded being of so much lighter material.

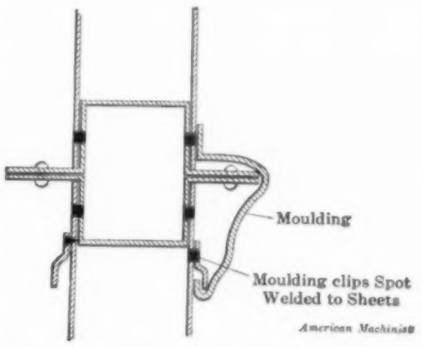



FIG. 5. SECTION SHOWING UTILITY OF MOLDING

The gas welding is only used on portions impossible to be reached by a die, such as corners of door frames or joints of molding.

### DOORS

The doors are made after the same method as the partitions, the panel work being stamped in the flat sheet. The molding around these panels is sweated

on, and when the doors are completed they give the appearance of a first-class cabinet-maker's work. The hinges and latches for the doors are screwed on in a jig, thereby overcoming any possibility of an imperfect fit of the door when erected.

A great deal of care must be used to keep the work perfectly flat and level during the electric welding as the excessive heat has a tendency to buckle it. This is accomplished by having a welding machine with the heads extended from the body of the machine over a movable table. The tables are on a track and have a slot in them just large enough for the die on the lower head to form a contact with the work.

After the welding is done the work is returned to the construction department to be smoothed up and have any sharp edges removed. It is then inspected very rigidly for any defects and finally passed on to the finishing department where it is given a coat of filler, rubbed down, and given a coat of ground, which is baked on in gas ovens. It is then ready for shipment to the erecting department.

# Homemade Pattern Letters and Figures

*By Oscar E. Perrigo*

In carrying out the modern systems of the classifying, marking and recording sets of foundry patterns it is frequently necessary to use large quantities of pattern letters and figures. A condition of this nature occurred under the charge of the writer in which many thousands of letters and figures were needed to properly inaugurate a new system of this kind. The expense necessary having been objected to by the management, some efficient and economical method of producing them was sought for.

After a somewhat lengthy consideration of the matter and some fruitless experimenting with suggested plans the following method was worked up and used with entire satisfaction not only as to its efficiency and economy but as to the quality of the product and the ease with which the letters and figures were applied to the patterns. The method of doing this work was as follows.

The letters and figures wanted were each to have two or more sharp points projecting from the back, by which they might be quickly and permanently attached to the pattern. This form is shown in Fig. 1. The plan was to make good and durable molds and to cast the letters of an alloy similar to type metal. To make molds of metal, as brass, and work out the forms by hand would have been much too expensive. Therefore some cheaper method must be devised.

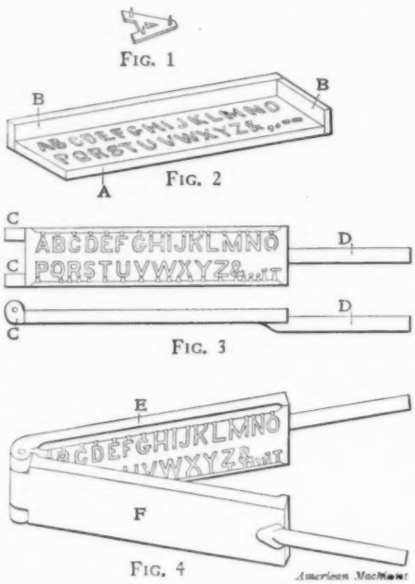



FIG. 1

FIG. 2

FIG. 3

FIG. 4

HOMEMADE PATTERN LETTERS

### MAKING THE MOLDS

Several sets of good pattern letters and figures of the "sharp gothic" style were purchased. A half-inch board *A*, as shown in Fig. 2, was prepared, shellacked and rubbed down, after which a rather heavy coat of shellac was applied and the letters arranged upon it as shown, while all around it were placed the strips *B B* in box-like form. The letters were very slightly oiled, and plaster of paris was mixed rather thin, poured into this box and as it was beginning to set was rammed down hard. When the plaster had thoroughly set the strips *B B* were carefully removed and the plaster cast separated from the board *A* and the letters. It was then smoothed up on the back. The chamfers to facilitate pouring and the "gates," one or more to each letter, were carefully cut, and it was given two light coats of shellac. The hinge lugs *C C* and the handle *D* were made of wood but not attached to the plaster. This served as a pattern which was carefully molded in fine sand and a casting made of brass. The casting appeared as shown at *E*, Fig. 4.

In the meantime a wood pattern was made for the other half *F* of a jointed mold shown in Fig. 4, and also cast of brass. This casting was planed up on the face and casting *E* fitted to it by a slight straightening with a hammer and a file finish. The two were then clamped together and the rivet hole in the hinge lugs drilled and the rivet inserted. It will be noticed that the alphabet is arranged in two lines so as not to make the mold too long and narrow, and the "gates" so made as to pour the metal from either side so as to avoid long gates, which would have the effect of cooling the metal and result in defective letters.

A smaller mold for figures was made in the same manner, except that in arranging the figures there was one of each figure, with the exception that there were three of figure 1, two of figure 6 (reversed to form the 9), and four of the figure 0.

The sharp points on the back of the letters and figures were provided for in this manner. The mold was closed and some melted lead, heated very hot, was poured into the mold. This marked the outline of the letters on the plain side of the mold. The location of the points was then marked with a prick punch. A small twist drill was ground to the proper form and the holes drilled to the depth required.

### THE ALLOYS USED

The molds having been made the more difficult conditions of casting had to be considered and solved. This required considerable patient experiment in order to obtain a proper alloy, and to ascertain the proper temperature of the mold. This temperature was finally found to be much higher than at first supposed practicable. First the proper alloy. Various proportions of lead, antimony and bismuth were tried. A fair success was reached, with one of lead, 90 parts; bismuth, 10 parts. But this was later on improved by one composed of lead, 70 parts; bismuth, 12 parts; antimony, 18 parts.

Possibly the addition of a small quantity of tin might have improved the alloy, but in practice it is well to avoid too many ingredients lest mistakes in the exact proportions occur.

In the process of casting, the mold was closed and clamped by slipping a ring over the handles in the same manner that the blacksmith does over his tongs. It was necessary to heat the molds over a gas flame, hot enough to slightly discolor a pine stick held against them. The alloy was melted over a Bunsen burner, care being used not to overheat it, as even slightly overheating tended to destroy its fluidity. The test used was that it be hot enough to burn a pine stick to a rich brown.

An apprentice boy in casting these letters and figures used two molds, one in the process of heating, while he was casting with the other. By the use of these molds and the proper alloy, a boy was soon taught to be able to produce between two and three thousand good letters and figures per day. There was no finishing work required except to clip off the "gates" with a quarter-inch patternmaker's chisel, held at the same angle as the inclination of the side of the letter.

# Flow of Metals in Heading Cold Forging and Swaging

## *Action of Materials Handled Under Various Pressures in Dies*

By H. P. Townsend *

The subject of dies for all sorts of purposes has been productive of a very large amount of current literature and bound volumes with innumerable illustrations and drawings. This has been confined, more or less, in nearly all cases to the construction and operation, but very little has been said in regard to the action of the metal being handled with relation to its contact with the dies in swaging, cold forging or heading operations and the internal strains and conditions produced in the metal itself. It is these points with which this article is intended to deal and it is to be hoped that the principles advanced will prove useful in the making and finishing of dies for this class of work, in that, with an idea of what takes place at the instant the operation is being performed, those engaged in the making of such dies can more intelligently experiment and develop tools which will perform their work with the greatest ease and durability causing the metal to flow in the most practical way for the best results.

Take for instance, a round cylinder of soft basic stock, such as is used for the making of screw and bolt blanks. If this cylinder is, say 5/8 inch in diameter by 1 inch long, and is squeezed between two flat dies, it will be noticed that the cylinder bulges to a barrel shape and finally begins to split around the sides about midway of its length. These splits do not extend clear to the end of the cylinder, but taper off from their widest point at the middle to nothing, as they approach the ends.

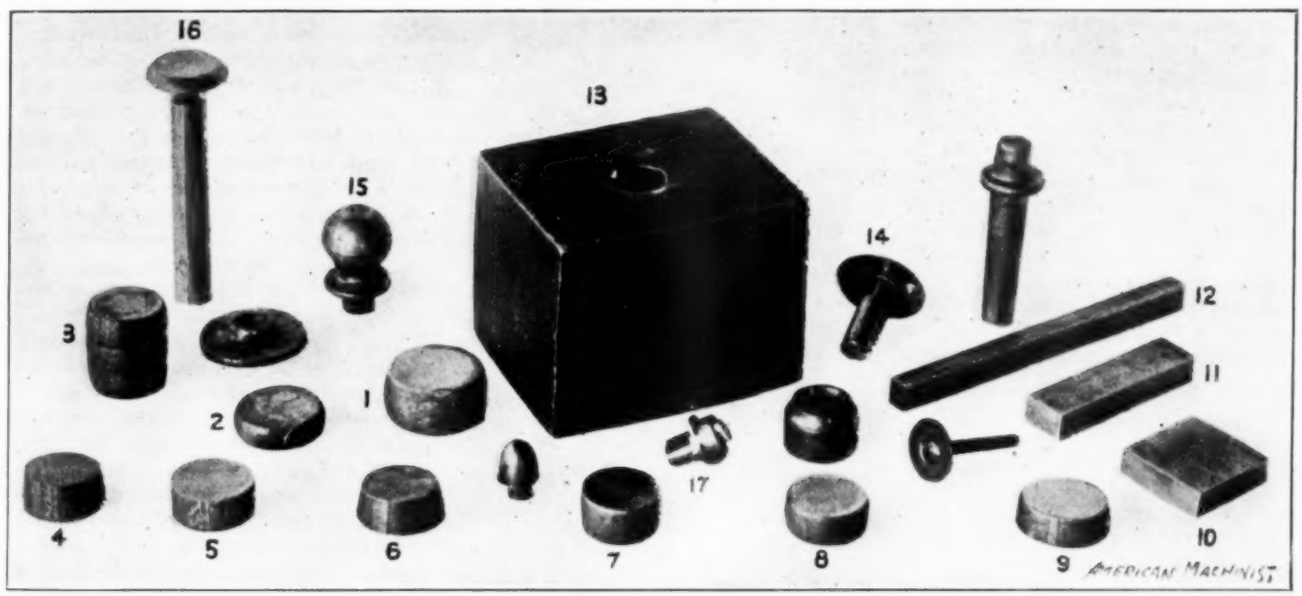
### Effect of Friction

It may have occurred to a few to ask, why does the cylinder assume the barrel shape instead of expanding equally throughout its entire length? The reason is entirely due to the friction of the dies on the end of the cylinder. This friction is remarkable, being sufficient to hold the metal against expansion at the points of contact, so that the expansion at the ends of the cylinder will never equal that at any other point.

This fact may be easily proved by cutting a cylinder like the one mentioned into three equal parts, piling them on top of each other and then squeezing. It will be found that the two end pieces have assumed a taper form, while the middle piece has expanded equally throughout its entire length, the two end pieces acting as a lubricant and allowing the molecules of the middle piece to flow naturally. The pressure being applied entirely in one direction, causes them to be compressed in parallel lines corresponding to the lines of force and as the length is decreased, the diameter is correspondingly increased. If the metal is of good, uniform quality, this increase is equal throughout the length and, if sufficient pressure is applied, this central piece will split at the sides, this split in this case being uniform from top to bottom. These two experiments illustrate the holding power of the die friction and of the action of the metal with this friction overcome. They are fairly conclusive and easily tried. We shall refer to another later where tools require a varying amount of pressure to squeeze different shaped sections of equal area.

### Metallic Lubrication

The simple action of the two end pieces, mentioned as forming a lubricant, illustrates very nicely the principle employed on armor-piercing projectiles on which a soft-steel or iron cap is placed over the point to act as a lubricant to the shell on its passage into or through the hard armor plate. Without this lubricant, the shells would have little effect, as the friction set up by the immense force of the contact between the shell and the armor plate would hold the forward part of the shell so strongly against advance that the rear portion, with its great momentum, would continue its advance and the shell would be crushed in pieces. This action of the armor-piercing shells is in itself a most interesting demonstration of the great resistance to the flow of metals caused by simple friction. Expansion of the cylinder is caused by the outer portion having to make room for the molecules of the inner part of the cylinder as it is squeezed together and is hindered at the center of the cylinder's length by noth-




Examples of the Principles Laid Down, Showing Effects of Metallic Lubrication, Quick and Slow Pressures

*Secretary, H. P. Townsend Manufacturing Company.

ing but the tensile strength of the metal, while at the ends it is hindered by the combined strength of the metal and the die friction.

Now, in a piece of small diameter, the sectional area of metal surrounding any given diameter of core is much less than it would be in a piece of greater diameter; also the area of the contact with the die surrounding any given diameter of contact circle is less than it would be in a larger piece. In consequence of this, the central molecules of a cylinder under end pressure meet with less resistance to expansion in a small cylinder than in a large and a frictional resistance is correspondingly less. Therefore, a cylinder having twice the sectional area of another, instead of requiring twice the amount of pressure to squeeze it a certain distance, requires twice the amount of pressure plus the increased resistance offered by the molecules near the center. This resistance being increased by the previously mentioned increased resistance to expansion by the larger amount of surrounding metal, the pressure required to start the endwise motion is increased rapidly as the diameter of the cylinder is increased. This proportion of increase has not been exactly figured but apparently follows the same lines as many other physical principles, that is, the increase of pressure required is as the square of the increase in the sectional area, and it is to be remarked that this applies to sectional area of the same shape.

### Effect of Shape

Referring again to the example of the varying pressures required to squeeze equal sectional areas of different shapes; apparently, the round form is the easiest of any of the regular sections, such as square, hexagon, etc. The variation in pressure required for these is, however, very slight and need not be commented upon. The following illustration will assist many times in the selection of a light machine or a heavy machine for doing a certain piece of work, as the difference in pressure required for some sections is surprisingly great. Take for example, the squeezing of three pieces of soft basic stock, each having a section of one square inch, one being an inch square, one being 2x½ inch, one 4x¼ inch and all being ¼ inch thick.

The experiment was tried on a heavy open-back press, this style of press being of such construction that with a heavy balance wheel a slight amount of spring or give could take place when the press was strained to its utmost. Any open-back press of this type will give this same spring, if anyone desires to try the experiment. The press was first adjusted to squeeze the one-inch square section sufficiently to show 0.005 of an inch compression. After this had been done, the piece ½ inch wide by 2 inches long was placed between the dies without changing the adjustment in the least, and the press shaft was again turned over. This section offered less resistance to compression than the first to the extent that it showed a compression of 0.022 inch. Then the pressure was applied to the piece 4 inches long by ¼ inch wide, the adjustments still remaining the same, and this showed a compression of 0.048 inch. In the first case the balance wheel almost stopped on the center, so great was the pressure, and in the last case the pressure required was so much less that the balance wheel was not perceptibly retarded. One of the largest manufacturers of cold headers has squeezed a head onto a bolt blank of 1 square inch area and it has been found in their experience that a machine having a double-frame section of 184 square inches with a 3000-pound balance wheel is none too heavy to practically perform this work, yet, owing to the difference in shape of section, a square rod ¼ inch on a side and 4 inches long can be flattened with perfect ease in a press having a frame section of 64 square inches and a balance wheel weighing 750 pounds.

These examples in variation of the pressure required to compress equal sections of different shapes, are readily accounted for and explained by the application of the principle laid down, that is, the holding power of the frictional contact of the metal against the dies. In the case of the square sections, the metal around the outer edges is squeezed by the dies and the friction that is formed causes this outer metal to cling tenaciously to its position and offer serious objections to moving therefrom.

Also in the square section with the metal distributed regularly on all sides of the central point, we have a distance of at least ½ inch from the center, in all directions. Therefore, we may consider that we have a band of metal 5/16 inch thick surrounding a central core ⅜ inch in diameter and the friction on this surrounding band holds it so firmly from sliding outward on the face of the dies that this inner core has no chance to expand in diameter, at least, its chances are so greatly reduced by the resistance of the outer portion of the metal that, as it is held from expansion, the possibility of compression is greatly reduced and the pressure required to effect such compression is greatly increased. Hence, this core is the portion which really requires the great pressure for reducing the dimension of the whole mass. The effect and extent of this increased central pressure can be clearly shown by taking a piece of soft basic stock of an inch diameter and about ⅜ inch in thickness, and squeezing it between two dies of soft tool steel. The effect will be to form a much deeper indentation in the middle than at the edges of the round piece; in fact, the dies will show a very deep indentation for about ¼ inch from the center, while at the edges where the frictional surface in contact with the dies becomes less, and, having less metal in front of it to obstruct its free outward flow, the dies will show practically no effect. All these things then teach that any kind of lubricant which it is possible to apply reduces the amount of power required to squeeze the work, and therefore, will increase the length of life of the tools. From these experiments it will be seen that these points are of much greater importance than is ordinarily supposed.

In many cases it is difficult to apply lubricants; especially in heavy work is it almost impossible to apply any lubricant which has a body sufficient to remain in place. If we apply this theory of the friction of the metal on the dies and the effect of the surrounding metal upon the interior core, to the long, narrow piece, which we have mentioned, it will be seen that nearly all of the metal in this long, narrow strip is but a short distance from the center. Therefore, none of this metal has any great amount of frictional resistance or other metal in front of it, and little resistance is offered to the outward flow of the central portion caused by the compression desired. Hence, the lighter machine spoken of has ample strength to perform the work.

Again, to refer to the use of lubricants. There are some cases where lubricants are of such necessity that work cannot be done without them to have the tools stand long enough to pay for the making, and many times it is impossible in any way to avoid this. However, there are two methods which can sometimes be employed and which give very surprising results. One is to give the article or material to be squeezed a coating of brass or copper plate. On small articles to be squeezed individually, ordinary methods of plating may be employed. Only a small amount is required and the saving of tools is infinitely greater than the cost of applying this plate.

### Brass Plating for Lubrication—High Speed Steel Dies

Great difficulty is sometimes experienced in solid-die cold headers used for making bolt and screw blanks, rivets, etc. in knocking out the blank from the die after it has been headed. As a general rule, in making iron blanks, eight times the diameter of the wire is the practical limit of length which can be knocked out and ten times the diameter is about the extreme length. To overcome this limiting of length sometimes the dies are made slightly tapering, or the application of a brass coating to the wire (and this wire is on the market) so greatly reduces the frictional resistance to knocking out that blanks of 12 diameters of length

may be made and successfully pushed out from the die.

Another method of overcoming this great frictional resistance experienced in squeezing operations has in itself no relation to the material or the application of a lubricant, but merely in the use of any of the high-speed steels for making the dies. They must, of course, be hardened so that there are no pits in the surface, and polished smooth. Dies made of this material will perform their work much easier than carbon-steel dies. This is because the high-speed steel seems to be of a slippery or greasy nature, which may readily be seen by rubbing carbon steel with a fine oilstone or slip. The stone will readily take hold and resist movement on the surface, but when applied to the high-speed steel, unless the contact pressure is greatly increased, it will slip over the surface with but little hold.

In securing various forms of bolt or rivet heads, it becomes necessary to give the dies and punches very particular shapes in forming difficult heads. Double-stroke, sometimes triple- and even quadruple-stroke headers are used, the object being to produce successive blows, each blow performed by a punch of different shape, gradually bringing the metal to the desired form a little at a time. Each operation strains and distorts the fibers of the metal at the start and at the finish of the stroke gives it a squeeze over its entire surface, again compressing it; thus giving the metal new life and homogeneity. The shapes used for these various punches are determined in difficult cases, first by judgment, then by experiment, and it is to be regretted that, although the experience in making such tools has been large, there are no rules or instructions, except in a general way, which can be given for forming them. It is customary to resort to the innumerable samples which previous work has produced.

### Cheaper Steel Best for Dies

There is one more vital point which should be mentioned; that is, for ordinary work of this character of cold forging or heading; the material used for the dies and the hardening of them. It is the erroneous belief of most people that the highest quality of steel will give the best durability. In the cold-heading process such is not the case. Cheap steel costing six or seven cents a pound but of good homogeneous material, is the best for the purpose. It should have as low carbon as will harden readily. The reason for the selection of this material is, first, experience and the explanation of its advantage is that it is capable of being heated hotter than the high-carbon steels without danger of burning. This being true, the low-grade steel hardens much deeper and it is depth of hardening which makes the heading dies stand up to their work. If high-carbon steel is used, it is not safe to heat it much higher than the hardening temperature, which is comparatively low and as a consequence, the chunky dies which are commonly used in the swaging processes, although good and hard on the surface, the hardness does not run in very deep and does not have sufficient backing to hold it up to the work, so that the dies will settle. Another reason is that low-carbon steel in hardening has less tendency to warp, so that the strains in it caused by the hardening are much less severe than in high-carbon tools and consequently leave them more nearly their normal strength. It has been found by experience that the best results are obtained by heating the steel to a much higher temperature than is required to harden and allowing it to cool off slightly in ashes. This leaves the outside somewhat cooler than the inside, permitting it to be dipped into very cold water without danger of cracking and with less internal strains than when it is dipped directly into the water from the fire, at which time the outside portion has the highest temperature.

### Types of Machines—Effect of Speed

Now, to speak of the type of machines which will perform this work of cold forging in the best manner. To begin with, metals are more or less fluid, and, for the sake of illustration, we will compare them to molasses candy. Following this idea, it is well known that a bar of candy may be bent slowly without breaking, but, if sudden bending takes place, it snaps like glass. Metals will act the same and I have pierced a block of cold machine steel 1 9/16 inches thick with a 7/16-inch hole, the punch being a plain, straight piece of drill rod and unsupported by collars or the like. The only requirement to do this is slow pressure, the speed of the punch being about 2 inches per minute. Now, if this is the case, the increase in speed means an increase in power required, and therefore the slower we can apply the pressure, the greater results we should expect to attain. This being generally acknowledged, it has been the custom to select machines supplied with toggles or knuckle joints, as they give great power and apply it much slower than crank-operated presses or headers. There are certain classes of work, such as the coining of money or medals, in which a sharp design is required. In such cases, the slow pressure gives by far the best results, and often when even a slower pressure than that given by toggles is required, a hydraulic press is used.

This would seem to indicate that in all cases a toggle-joint machine would have an advantage over a quick-operating, direct-acting, crank machine, but for plain swaging or the heading of bolt blanks or screws where no particularly sharp design is to be produced, the quick crank machines have proved themselves by far the best. This seems like a contradictory statement to the foregoing, but the conditions are different, in that, in bringing up sharp designs, the amount of distortion of the metal is not great, while in forging, especially in the heading of rivets, bolts, etc., the greatest amount of distortion possible is oftentimes the object desired and while it is true that a very slow pressure would give the results, it would be impossible to use it commercially, as another desirable feature in this class of work is the speed of production.

Next in speed to the crank come the toggle-joint machines. These produce a slow pressure to a certain extent, but they do not produce sufficient speed of action to materially increase the heat generated in the work by the distortion and rubbing of its molecules. We might consider then the toggle-joint machines as performing their work at about the neutral point of slow, easy flowing of a metal and the softening of the metal by increased heat, produced by increased speed of action. This condition of increased heat is readily gained by the high-speed direct acting crank headers or presses and with them, larger heads of more difficult form may be produced on much lighter machines of this type than of the toggle-joint type for the reason of the increased temperature in the work.

### Effect of Temperature

This temperature condition is a thing of which we believe very few people are aware; at least, they are not aware of its importance or of how great a difference a few degrees in temperature makes. As a practical demonstration, we know of cases where, in drawing tubes or shells, it has been found by comparatively ignorant operators, that on a cold morning they will break and tear, while on a warm day no trouble is experienced. As a result of this, a heating apparatus has been introduced near the drawing presses and the shells laid on a tray and warmed, not, however, sufficiently to prevent their handling. With this slight increase in heating, operations could be performed which were absolutely impossible at the lower temperature. As a consequence, it can be readily seen that a quick-acting crank machine, which will raise the temperature of the work so that it will scorch the floor as it falls and sometimes even to the point of starting the color of the metal, will give a correspondingly increased effect.

To further illustrate the theory of the softening by heat, we all know that heating to redness or welding heat, visibly softens the material and, as the metal cools off, it grows harder with every degree of temperature lost. Nearly every toolmaker or blacksmith believes that when a metal loses its notable softness

and gets hard, as the common expression goes, this is as hard as it will get by slow cooling and, if so, our theory of the advantage of increasing the heat by speed would fall flat, because we cannot produce heat enough even in the direct-acting crank machines, to bring the metal to visible softness or red heat. However, as we reach the normal temperature in the cooling of the metal, if we suspend a bar or tube by a string, we can notice a different tone when struck by a mallet, as the temperature decreases, yet the hardness does not increase noticeably except as we can tell it by this tone, until we resort to the use of liquid air. With this we can reduce the temperature to some 400 degrees below zero which is sufficient to render the toughest piece of bicycle tubing like glass, so that, when dropped on the floor, it will break into fragments and resist effectually the efforts of a file to cut it. When the piece is allowed to resume its normal temperature, it is again as tough as ever and when heated to redness is soft and pliable.

These two experiments of temperature, producing these two marked effects, together with the variation of tone through the various temperatures between, show conclusively that for every degree of heat added to the material being worked, a corresponding softening is produced. It can readily be realized how important an advantage this is and how much more difficult work can be produced by the rapid-crank type of machines.

To comment upon the mechanical action of these machines in order to further assist the toolmaker, or superintendent, in the selection of the best machine for his purpose, we would note that the slow final action of toggles has the very objectionable feature of squeezing the oil film from between the surfaces of the bearings, while in the crank machine, the work is performed as the crank passes the center at high speed and is done so quickly that the oil film or cushion is preserved. The absence of direct contact and wear on these hard-working parts, points to the selection of the crank type of machine for rapid production and the greatest possible amount of effectiveness.

Although hundreds of rivet or bolt-heading machines have been made for heavy pressure, using the crank, and have displaced in many of our larger factories the toggle type of machine, the crank type of mechanism has not yet been applied to any great extent to presses for swaging or rough upsetting. Yet it has the same advantages in press construction that it has in the heading machines and in press construction produces a much cheaper machine to build and maintain or repair.

### The Examples

In the accompanying halftone will be seen various sample pieces to illustrate the principles and theories laid down.

Sample No. 1 shows a cylindrical piece squeezed between two plain dies, cracked on one side, the crack disappearing at the ends and widest in the middle.

Sample No. 2 shows the same thing of a poorer quality of stock.

No. 3 shows three pieces piled together, forming a cylinder which was originally exactly the same as No. 1.

Nos. 4, 5 and 6 show a similar sample separated, Nos. 4 and 6 showing a decided taper, the small end being the one held against the die and prevented from expanding by the friction. No. 5 shows the central piece in No. 3, which has no taper; Nos. 4 and 6 acting as a lubricant for allowing the metal in No. 5 to flow naturally.

No. 7 shows a plain cylinder squeezed with a given pressure between two dies, not lubricated.

No. 8 shows a cylinder exactly the same as the original of No. 7, squeezed between two dies with exactly the same blow as No. 7 received, but with the dies lubricated with a very thick grease. The difference in the amount of compression is about 20 per cent.

No. 9 shows sample No. 8 struck by an additional blow of the same force with the top die dry and the lower die lubricated, showing the difference in the flow of metal on the dry and lubricated surfaces.

No. 10 shows a block 1 inch square, ¼ inch thick.

No. 11 shows a block 2 inches long, ½ inch wide, or twice as long and half as wide as No. 10.

No. 12 shows a block four times as long and one-quarter as wide as No. 10. These pieces, all of the same material, equal area and equal thickness, under the same pressure showed the difference in compression already spoken of.

No. 13 illustrates the slow flow of metal (compared above to molasses candy) and is ordinary machine steel 1 9/16 inches thick with a 7/16-inch hole punched entirely through it at the rate of 1½ inches per minute, by a plain, unsupported punch. This shows the extreme of work done under slow pressure.

No. 14 shows a large, thin head on a special bolt blank, having two conical projections underneath the head. This shows the extreme of work done cold by quick pressure, and the result cannot be obtained in any other way without splitting the edges of the head. This head is on 9/32-inch wire, 1 inch diameter, ⅛ inch thick at the center and 1/32 inch thick at the edge.

Sample No. 15 shows the tip on a common hinge-pin. No. 16 shows a bevel-gear blank.

The other unnumbered samples show articles of manufacture which are not in the class of screw blanks or rivets, but are usually made on automatic screw machines or by some other process, where much stock is wasted. Some have comparatively long shanks, some short shanks and some no shanks at all.

No. 17 has its shank flattened, the other end having a flattened projection at right angles to the shank.

Most of the theories and experiments mentioned were noted in the plant of the E. J. Manville Machine Company, of Waterbury, Conn., in connection with practical demonstrations of their modern machinery for cold-forging and heading processes for the production of bolts, screws and rivets and many other articles of manufacture now made on screw machines. Among these should be mentioned small gear blanks forged on their spindles; solid, one-piece collar buttons, horseshoe calks, bicycle cones and cups, ball-tipped hinge pins, etc. All these are produced by this modern process of cold forging from the coil of wire at the rate of 60 to 150 per minute, without any loss by scrap and as true and accurate to size as usually made by the finest screw-machine work.

## Brakes for Ships

It is said that what is really a very old idea in ship equipment, but which, until recently, had never been tried, is now being tested in the United States Navy.

This device takes the form of folding wings or blades at the stern of the ship, which may be swung out in the water to act as a brake to stop the ship. At first sight it is hard to perceive any advantage in this arrangement over the reversal of the ship's propeller, as has heretofore been the practice, but the introduction of the steam turbine, with its inability to reverse, especially at short notice, or with anything like full power, has pointed the advantage of the brake device.

It is said also that the large braking surface is really more effective than the reversal of the propeller, even at full power, and the brake has the additional feature of aiding in a sudden, sharp turn to avoid a collision, by swinging out but one brake wing at a time.

The effect of the brake shows itself in a huge wave at the side of the ship, which increases in size until the ship comes to a stop.

One great fear at first advanced, was that the powerful action of the brake might seriously strain the hull, if it did not actually pull it in two. This objection, it is expected, will be overcome. Angularity of the brake wings is variable and entirely under control of the man on the bridge.

The battleship "Indiana" equipped with this form of brake made a several days' cruise to try it out and the results are reported to be favorable.

# Building Various Parts of Alco Car

*Editorial Correspondence*

Although the automobiles built by the American Locomotive Company, in Providence, R. I., have been well known, first as the Americanized Berliet, both for touring cars and taxicabs, the winning of the last Vanderbilt cup race has fixed the new name, Alco, very firmly in the mind of those interested in automobiles in any way.

Some of the methods used in the construction of these cars are illustrated in the accompanying photographs and it may be added that new methods are constantly being sought and applied.

Fig. 1 shows the boring of the engine crank case and the transmission case on a Lucas boring machine. It will be noticed that the boring fixtures are very complete. In the first view the crank case is bored for the crank shaft, the inlet and exhaust cam shaft and the pump and magneto shaft holes. Each has its own boring bar in substantial bearings, the bars being driven by two universal joints, which obviate the necessity for exact alinement in setting up and insure all holes being bored straight and true, without cramping the bars.

### Boring Cylinders

Fig. 2 gives a good idea of the jig or fixture used in holding the cylinders while being bored on the Beaman & Smith boring machine. This is a very simple but effective fixture, which is mounted on a revolving table so that rough cylinders can be set at the other end while the first pair are being bored, making it practically a continuous operation.

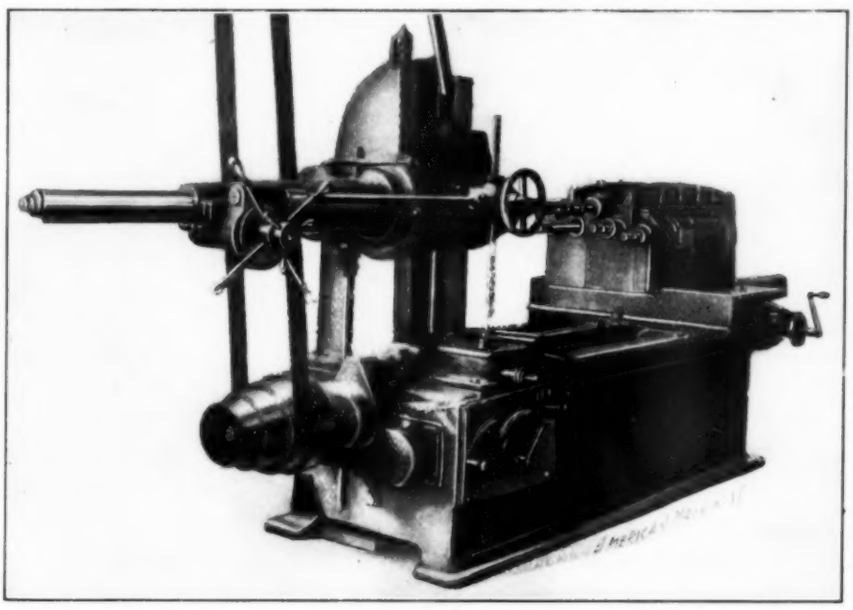


Fig. 1. Boring Crank Cases on a Lucas Machine

In Fig. 3 the flywheels are being turned in a Bullard vertical lathe, using a number of cutting tools simultaneously and making a first-class job in remarkably quick time.

The drilling fixtures which follow are particularly interesting. Fig. 4 is a box jig for drilling the spring hanger shown on the table beside the jig, another hanger being shown in position, ready for drilling. This drills the two holes which pass from the hanger to the chassis as well as the cross hole for the spring hanger bolt.

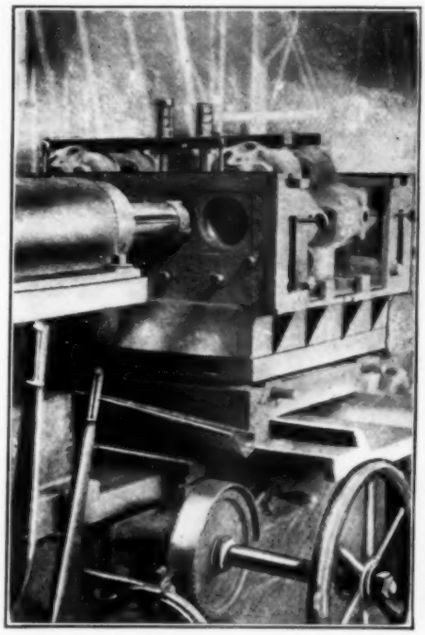


Fig. 2. Cylinder-boring Fixture

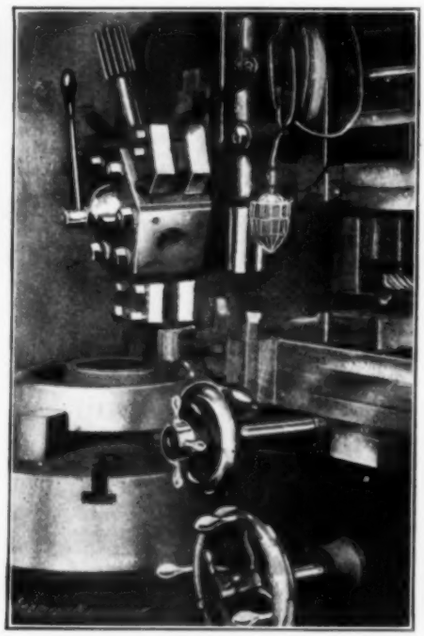


Fig. 3. Turning Flywheels

### Fixture for Steering Knuckle

Figs. 5, 6 and 7 show an extremely interesting jig for boring and drilling the steering knuckle, which is shown at the right of Fig. 7. Fig. 5 shows the two parts of the jig on the very substantial drilling block on which they are used. It will be noted that the steering knuckle is first clamped in the sliding block which is then pushed into place in the main fixture as can be seen in Fig. 6. When in position it is locked by the swinging arms shown at the right, and the work is held in place as in Fig. 7. This view shows the fixture first to show the other side with the projecting boring tool, which fits into the drill spindle.

While in this fixture the main hole by which the steering knuckle is fastened to the ears of the axle as well as the cross holes for the connections to the steering mechanism are produced. The steering knuckle itself is shown in place in the fixture as well as separately on the drilling blocks. The various tools, such as boring bars and reamers, as well as the locating bars and plug gages, are shown in front of the fixture.

### Milling the Cranks

Fig. 8 shows an interesting milling fixture which is on the order of the profiling attachment sometimes found in gun works, although in such cases the guiding roller is usually above the milling cutter. In this case, however, they are hardened-steel blocks fastened on the plate on the milling fixture as shown. In addition to these the whole fixture

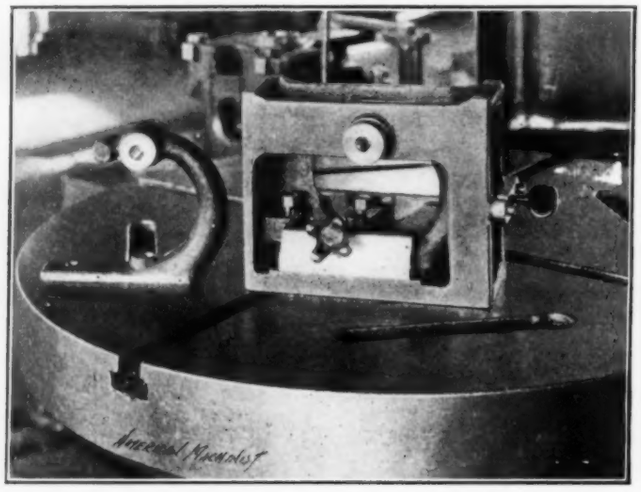


FIG. 4. JIG FOR SPRING HANGER

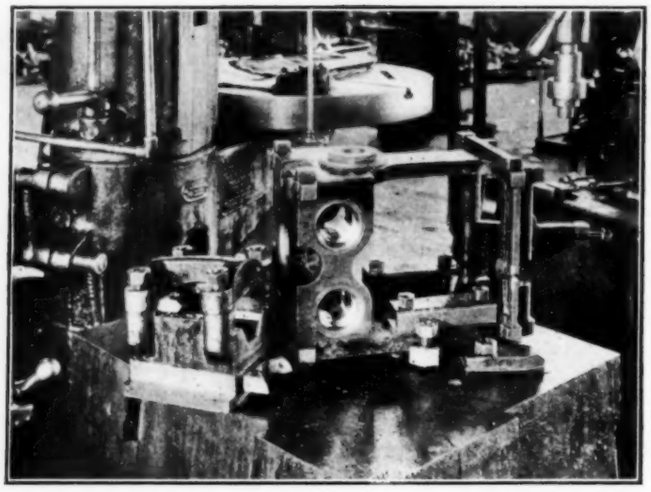


FIG. 5. JIG FOR STEERING KNUCKLE

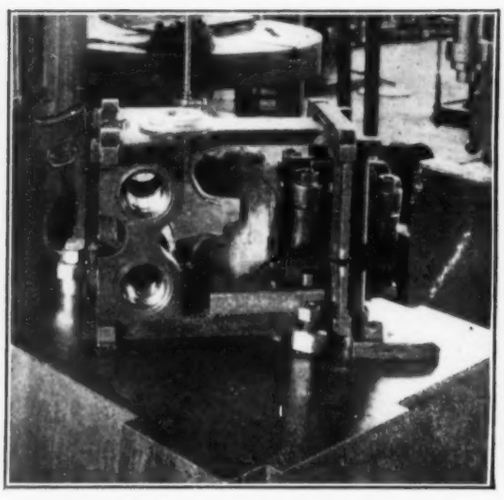


FIG. 6. PUTTING THE JIG TOGETHER

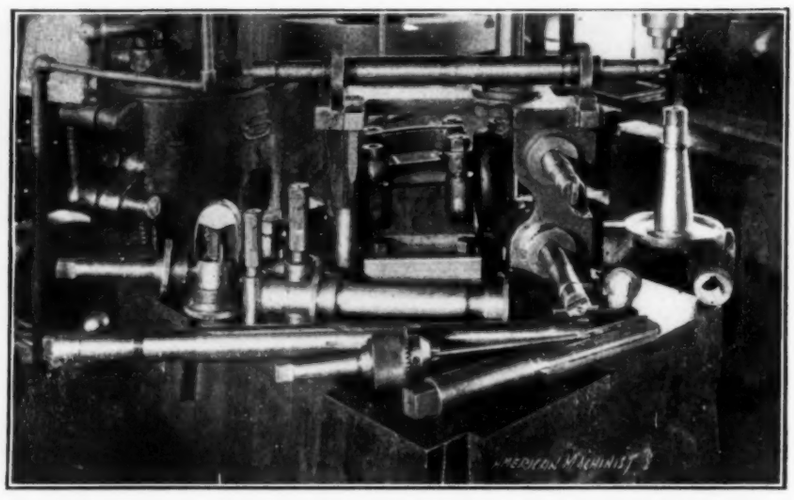


FIG. 7. THE JIG AND TOOLS USED

swings on a central pivot and is located at the correct angles by the indexing plugs shown at the right.

In this way the cross feed of the Becker miller on which the work is done, can be used. This allows the power feeds to be utilized for all the cuts and not only makes it easier for the operator, but also secures better results. Fig. 9 shows how the sides of the crank cheeks are faced off with an end mill on the same machine.

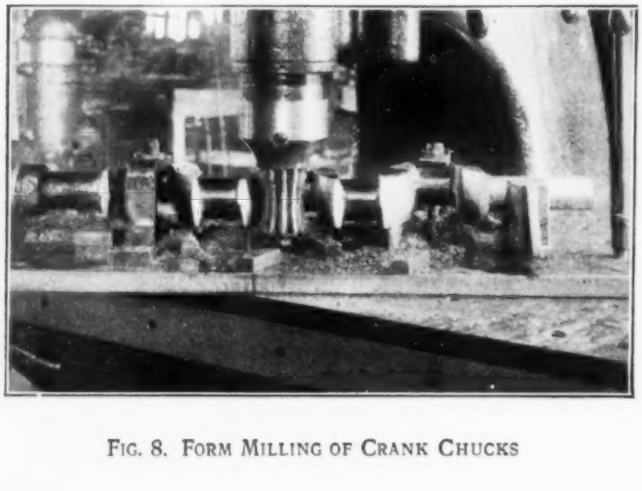


FIG. 8. FORM MILLING OF CRANK CHUCKS

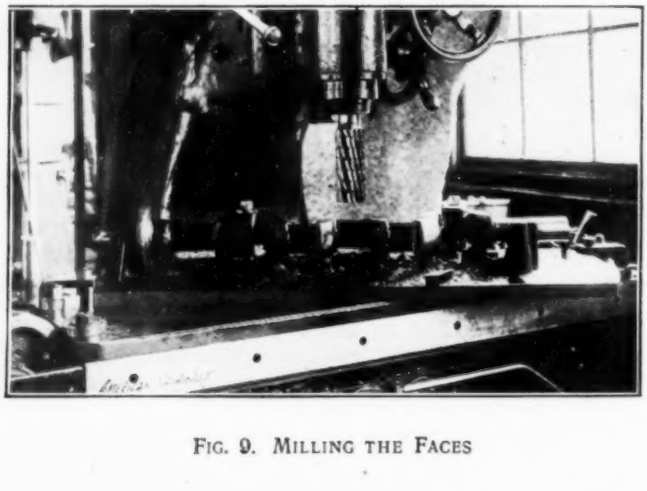


FIG. 9. MILLING THE FACES

# The Whitworth Quick Return Motion for Shapers

The Whitworth quick return motion is a well established piece of mechanism for driving the cutting heads of shapers. Although extensively used, it is perhaps not quite as well understood as it should be, owing to the fact that, as applied to shaping machines, the parts are very difficult to see.

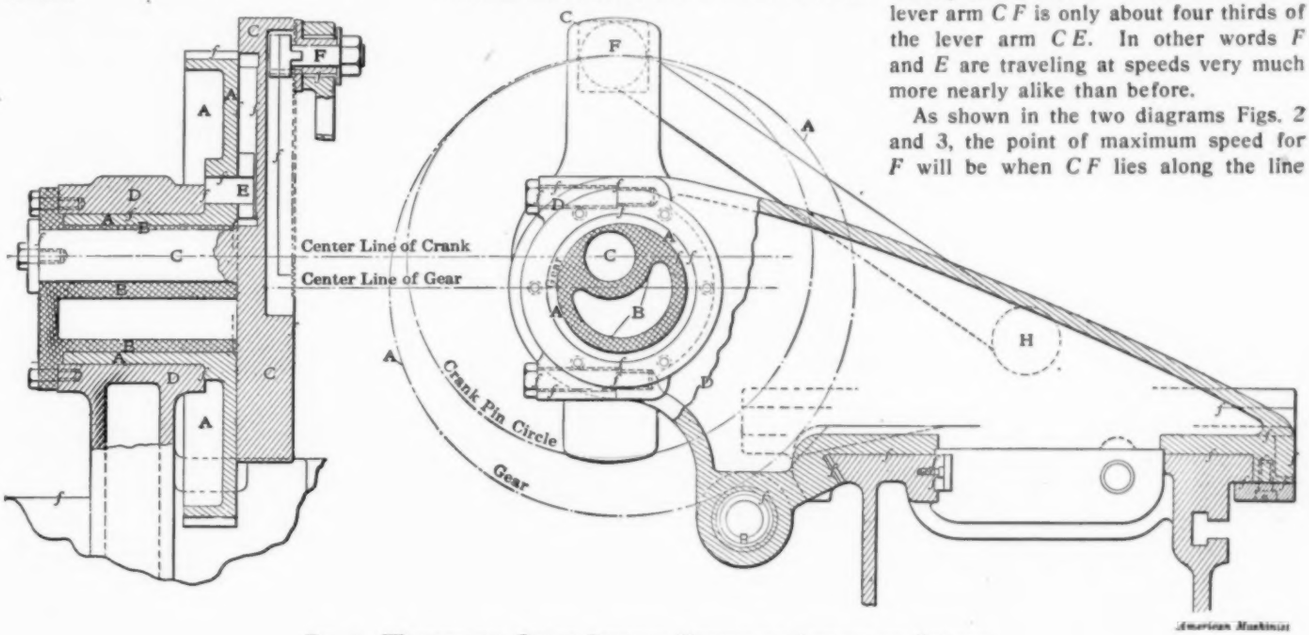



FIG. 1. WHITWORTH QUICK RETURN MOTION AS APPLIED TO SHAPER

In Fig. 1 there is shown a drawing of these parts of a shaper, as constructed by the Bement, Miles Company, of Philadelphia. In this drawing the connecting rod which drives the cutting head is *F H*. This connecting rod is driven by the crank pin *F*, which is adjustably located on a crank arm *C*. In the left-hand view of Fig. 1, this crank arm is seen to have a shaft extending through the bushing *B*. This shaft *C* is eccentrically located in the bushing *B*, and while *C* rotates, *B* does not, as it is rigidly held by the flange bolts to the housing *D*. Around the outside on the bushing *B* and inside the housing *D* revolves the sleeve of the gear *A*.

*E* is a pin with a swivel block, the pin being rigidly held in the gear *A* and the swivel block sliding in a slot on the back of the crank arm *C* as they both revolve. It will now be seen that the center of the crank-arm spindle is slightly eccentric to the center of the gear, and that the crank arm is driven from the gear by the pin and swivel block *E*.

In order to understand the reason for the alternate quick and slow strokes of the connecting rod *F H*, it will be well to look at Figs. 2 and 3 where the parts are shown in diagrammatic form. In these two diagrams the cross-hatched portion represents the bushing *B* in Fig. 1; also *E* in Figs. 2 and 3 represents the pin and swivel block driving the crank arm which carries the connecting rod *F H*. In the same illustration the point *B* is the center of the driving gear shown as *A* in Fig. 1. The eccentric circles in Figs. 2 and 3, represent the paths of the two crank pins, *F* and *E*. In other words *F* travels around the center *C* and *E* travels around the center *B*, while at the same time *E* slides along the slot in the crank arm *C F*.

Now it should be remembered that the pin in swivel block *E* travels in its circle at a *uniform* rate of speed and that it is by means of *E* that the crank arm *C F* is driven at a *varying* speed. Looking at Fig. 2, it will be realized that in the position there shown the crank pin *F* is traveling in its circle at about four times the speed of *E*, because the lever arm *F C* is about four times the lever arm *C E*. As shown in Fig. 2, this is part of the quick return stroke, the quickness being obtained by the relatively great length of the lever arm as described.

In the position shown in Fig. 3 the opposite state of affairs exists. Here, while the crank pin *F* is still traveling faster than the crank pin *E*, it is simply because *F* is outside of *E*, but while *E* still travels at the same speed which it had before, the crank pin *F* has very materially slowed down. This is because the lever arm *C F* is only about four thirds of the lever arm *C E*. In other words *F* and *E* are traveling at speeds very much more nearly alike than before.

As shown in the two diagrams Figs. 2 and 3, the point of maximum speed for *F* will be when *C F* lies along the line *C X*; that is, when *C F* and *B E* are in the same straight line. The minimum speed point of the travel of *F* will be when *C F* and *B E* lie along the straight line *C Y*. Between the maximum and minimum speeds of *F* its speed is gradually changing, starting first from the minimum at *Y* and then increasing gradually until reaching the maximum along *X*.

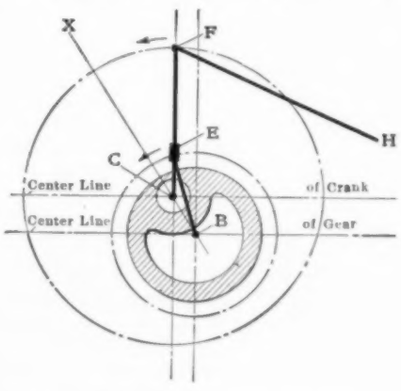



FIG. 2. QUICK RETURN STROKE

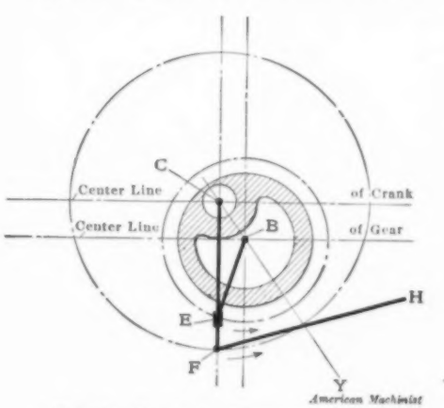



FIG. 3. SLOW OR CUTTING STROKE

Alteration of the stroke of the cutting head is obtained by sliding the crank pin *F* in and out along the crank arm *C F*. This is accomplished as shown in Fig. 1 by loosening the nut on the outer end of *F* and sliding the pin along the slot in the crank arm *C*.

# A Pioneer French Aeroplane That Has Made Many Flights

## *Monoplane Type of Good Workmanship with Ingenious Motor*

By Augustus Post *

Among the earliest constructors of aëroplanes in France is the firm of Robert Esnault-Pelterie, at Billancourt, whose famous monoplane was one of the first of its type to make successful flights. This concern also manufactures the well known motors which are commercially known by the initial letters R. E. P. All the parts of this motor and aëroplane are most skilfully made and beautifully finished, suggesting the work of jewelers rather than ordinary artisans; the design of the motor is unique, with its seven cylinders arranged like a fan. The R. E. P. aëroplane reveals a great contrast to the comparatively rough workmanship and indifference to finish of the Wright Brothers' machine, which is extremely simple, and hardly seems in keeping with its marvelous performances. One would expect to find the very acme of detail in the mechanical parts; but a piece of machine chain, for instance, forms a simple, but efficient, fastening for the braces running to the skids, and ordinary cotton cloth is used to cover the surfaces. Some of the French machines have as elaborate a show finish as if the aëroplane had reached the same fixed stage as the automobile, and it almost seems a waste of labor on apparatus which is still experimental.

Robert Esnault-Pelterie is one of the French aviators who has imagination, and works out his ideas for his flying machines to the last details, and sees them in his mind just as they will appear in the air. He was one of the very first men in France to experiment in aviation. His aëronautical work commenced in 1903, and later, in the year 1904, he carried out a series of gliding experiments near Wissant, with a machine similar to that of the Wright Brothers', which was intended to verify the American experimenters' statements. His results were nearly equal to those obtained by the Wrights themselves during their first year of experimenting. It was demonstrated that it was possible to glide at an angle of 1 in 10, and experience was gained that was later utilized in machines.

M. Esnault-Pelterie very clearly gave his preference to the idea of the monoplane, which he considered superior in many points to the biplane, for he has stated that it is capable of greater speed, flexibility, and stability, and in construction he has considered that the wires for bracing the biplanes offered much more resistance to the air than is generally supposed. With his continual desire for perfection, he has made many changes in his aëroplane and has studied how to reduce the weight of the internal combustion motor to the minimum, and has succeeded in creating an exceptionally good aëronautical motor along radically different lines from some of the other manufacturers. The R. E. P. aëroplane is very similar to the Bleriot machine in general outlines (see Figs. 1 and 2), but there are a great many detail differences to be noted, every one of them of great importance to the designer; the machine is very strongly built, and the whole design makes for compactness.

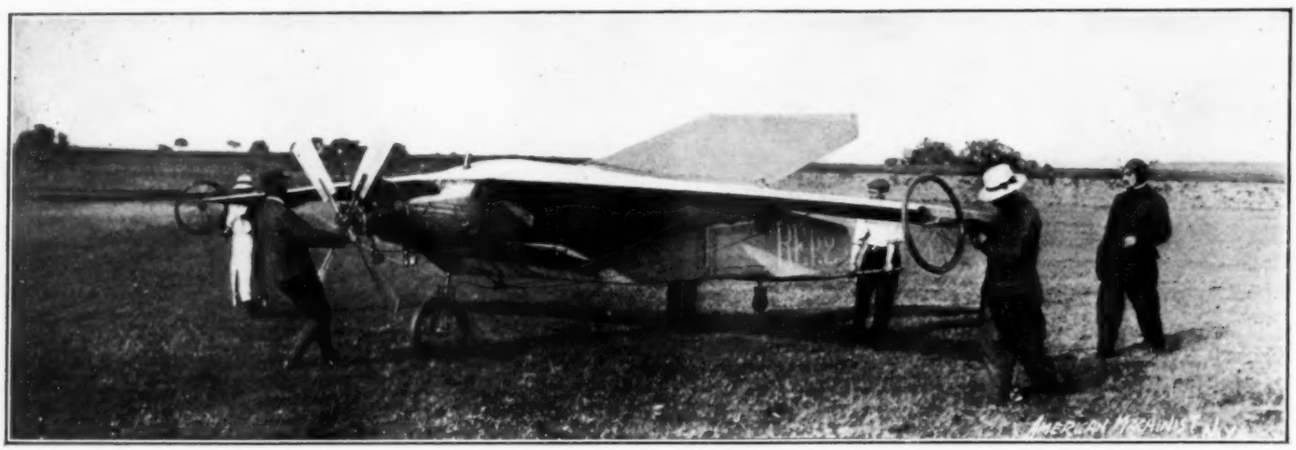


FIG. 1. PARTIAL FRONT VIEW OF ESNAULT-PELTERIE AEROPLANE

### GENERAL CHARACTERISTICS

The general characteristics of this aëroplane are as follows: It is a monoplane with flexible wings, which may be warped by means of four cables or main stays, two attached to the under side of each wing. A horizontal surface carried in the rear performs the function of elevating and lowering the machine, while longitudinal vertical planes assist in securing stability. Wheels are placed tandem under the body, one under the forward part and one under the rear; also one wheel at the outer extremity of each wing. The principal wheel has a pneumatic oil shock-absorbing device for landing.

The body is spindle shaped and is made of steel tubing, welded together into a single structure. It is braced by diagonal pieces of tubing so that it will stand strains in every direction. The motor is placed in the extreme forward part of the frame, with the propeller in front, coupled directly to the crank shaft. To the frame, on each side of the engine, the wing surfaces are attached. The operator's seat is placed between the wings, while the horizontal elevating and depressing surfaces and the vertical rudder forming the tail are carried at the extreme rear of the frame. Two levers regulate the entire operation of controlling the machine. It is small and compact; 9 meters 60 centimeters (30 feet 6 inches), wide, and 8 meters (26 feet 3 inches) long. The head resistance is reduced to a minimum, and the construction is thoroughly mechanical throughout.

### THE WINGS

The wings of an aëroplane are usually considered efficient in proportion to the relation between the weight carried and their surface. The wings of the R. E. P. are 9 meters 60 centimeters (30 feet 6 inches) wide, including the width of the body. They are very graceful in appear-

ance. The surface is 15 square meters (161 square feet), and the weight carried is 420 kilograms (925 pounds), 5.7 pounds per square foot of surface, at a speed of 60 kilometers (37 miles) an hour. They are built of wooden ribs fastened to two wooden transverse spars, and are very flexible. Each wing is held down by two cables, each of which supports one-quarter of the weight of the machine and runs to the lowest part of the frame, where all four are fastened to a very ingenious device like a double bell crank pivoted to the frame and operated by a vertical rod running to one of the main levers at the hand of the aviator. By moving this lever the cables holding the forward spars are loosened while the rear cables are tightened, thus warping the wing surfaces. The wing surfaces are very bird-like, and the aspect of the machine approaching with its extremely supple wings is very suggestive of a flying creature (See Fig. 4).

FIG. 2. PARTIAL REAR VIEW OF ESNAULT-PELTERIE AEROPLANE

### THE CONTROLS

The control of elevation of this machine is accomplished by a very broad and comparatively large horizontal surface at the extreme rear part of the body, which can be set at variable angles of incidence. The vertical rudder is placed at the rear extremity of the chassis, and forms a prolongation of the keel or vertical surface, which extends under the entire length of the body of the machine for the purpose of keeping it in a straight line of flight. The pilot sits in a "cockpit" in the center of the framework of the body, between the wings, and immediately behind the motor; a position well protected from any shock of landing, and where, from his hight, he can freely see the ground in front of the wheels.

The operation of the machine requires two systems, one of which controls the stability of the machine both fore-and-aft and longitudinally, and the other, which governs its direction both horizontally and vertically. A vertical operating lever is used for both systems. The lever for governing the balancing is placed at the left hand of the operator; it is mounted on a universal joint and is moved naturally in a direction to oppose the action of the machine; if it tips up in front, the lever is pushed forward and by wires which connect it to the planes in the rear, they are set to bring the machine back to its even keel. To cause the machine to rise or descend, this lever is pulled back or pushed forward; to govern the lateral stability, this same lever is moved to the left or right instinctively. This latter movement is transmitted by a lever and connecting rod to the device on the lowest point of the body frame, where the four cables which guy the wings down, are fastened.

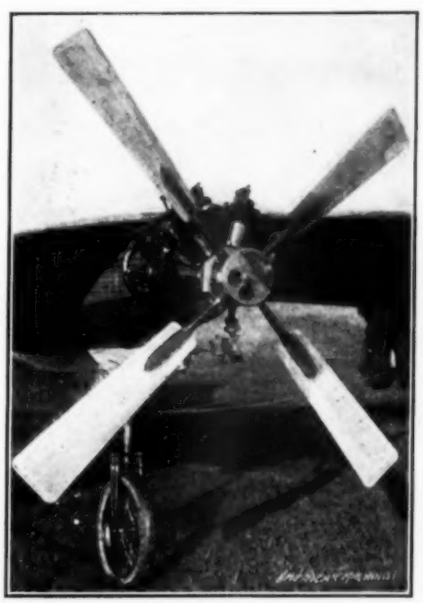


FIG. 3. MOTOR AND PROPELLER ESNAULT-PELTERIE AEROPLANE

If the machine tips down on the right side, by throwing the lever to the left, the right wing is warped and lifts that side, returning the machine to a condition of equilibrium. The lateral direction is governed by a vertical lever in front of the aviator, which moves transversely, and is connected to the vertical rudder. By moving to the right, the machine goes to the right, and by moving to the left, the machine goes to the left. A pedal is provided for the right foot, by which the speed of the motor may be governed, and small hand levers enable slight adjustments of the motor to be made.

### THE R. E. P. MOTOR

The R. E. P. motor (see Fig. 3) is quite unique, and has solved many of the problems which confront the builder of extremely light aëronautical motors in an original way. Its designer received the prize of the Society of Civil Engineers of France for its construction. The entire motor is built in Robert Esnault-Pelterie's own factory, in five-, seven-, and ten-cylinder types.

The first thought of the engineer, when it is desired to reduce the weight of an internal combustion motor, is to increase the number of cylinders; and the second is to shorten the crank-shaft, and to connect all of the pistons as closely as possible to one point, or the least number of points that can be mechanically arranged. In the ordinary four-cylinder motor, there is at any instant only one crank pin fully loaded by the explosion, while the other three are doing less than their maximum work; thus, as the stress is less, they could be built much lighter were it not for the maximum stress of the explosion.

To obtain this construction, the motor used in the R. E. P. bis. has seven cylinders, air cooled, mounted like the points of a star on the upper side of a circular crank case. Four cylinders are placed in one plane in front, and three in another plane in the rear, and they are "staggered" in such a way that the air can blow between two front cylinders directly upon one in the rear. The crank shaft has two throws 180 degrees apart. Four connecting rods are connected to one bearing on one crank pin and three to a single bearing on the other. There would be certain advantages if an even number of cylinders were placed at equal distances around a circular crank case, but the counter difficulties, such as those of ignition and lubricating cylinders in a

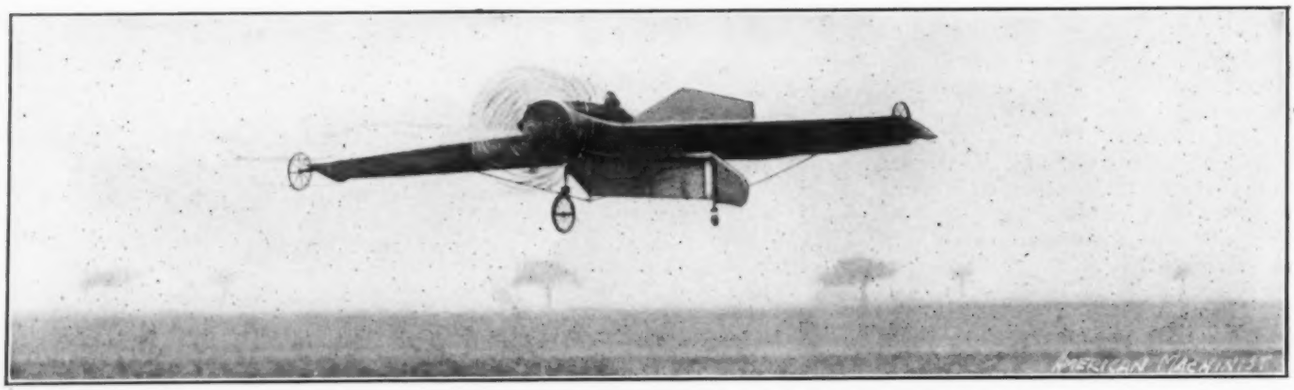


FIG. 4. ESNAULT-PELTERIE AEROPLANE IN FLIGHT

reversed position, caused the arrangement of the motor as it is. To balance the crank shaft with four pistons on one crank and three on the other, one of the sides of the crank is hollowed out, while the other is solid. The crank shaft is very short; it is made of chrome-nickel steel, and has an extra long bearing at the propeller end.

The pistons are made from solid steel and the head is unusually thin, but is strengthened to resist the force of the explosion. The bearings for the wrist pin are in a separate piece screwed into the head of the piston. There are two rings for each piston, which weigh complete, 1 3/10 pounds. Each cylinder of the earlier motors has a mechanical inlet and exhaust valve operated by a single piece of mechanism. This double valve is actuated by a rocker arm operated by one cam, which suffices for all the cylinders. This cam turns in the opposite direction from that of the motor, four times slower than the driving shaft for the five-cylinder motor, and five times slower for the seven-cylinder. This cam has a double face, one for each set of cylinders. Ignition is accomplished by a high-tension Simms-Bosch magneto, and two carburetors are used. The cylinders are air-cooled, and have thin ribs to increase the radiation surface. Lubrication is secured by the splash system. Protecting plates have been fixed at the base of the cylinders at the extreme left and right of the crank case, to prevent an excess of oil entering them. The bore of the cylinders is 85 millimeters (3.4 inches) and the stroke 95 millimeters (3.8 inches).

These motors are exceptionally light; the weight complete, without water, of the 20-25 horsepower is 53½ kilograms (118 pounds); the 30-35 horsepower, 68 kilograms (150 pounds); 40-50 horsepower, 97 kilograms (213 pounds). If a fan were added, it would increase the weight 9 or 10 kilograms (20 to 22 pounds). The horsepower is obtained at a speed of 1400 revolutions per minute. The complete crank case weighs 11¾ pounds.

The R. E. P. motor of the latest design has separate inlet and exhaust valves placed diagonally in the cylinder heads, instead of the combined valves used formerly. Both valves are controlled by the same rocker arm operated by a double-acting tappet rod. The tappet-rod motion is communicated by a cam ring having a grooved path. The new model is about 20 kilograms (44 pounds) heavier than its prototype, owing to this change in design, but the combined valves were not found altogether satisfactory and were abandoned. The seven-cylinder, 30-35-horsepower motor is used in the R. E. P. II bis and is mounted in the extreme front of the body frame by four bolts.

### THE PROPELLER

The propeller has four blades; it is 2 meters (6½ feet) in diameter, and is fastened directly to the crank shaft of the motor. The reservoir for oil holds 6 liters (1½ gallons), and 40 liters (10½ gallons) of gasolene are carried, which is sufficient for a two hours' run.

### STARTING AND LANDING

The starting and landing are accomplished by means of wheels arranged quite differently from any other machine. Two bicycle wheels are placed tandem directly under the body; the front one is the larger and supports the greater part of the weight of the machine; the smaller wheel is placed at the rear and supports the tail. At the extremity of each wing another bicycle wheel is fixed to prevent the wing from striking the ground when the machine has not at-

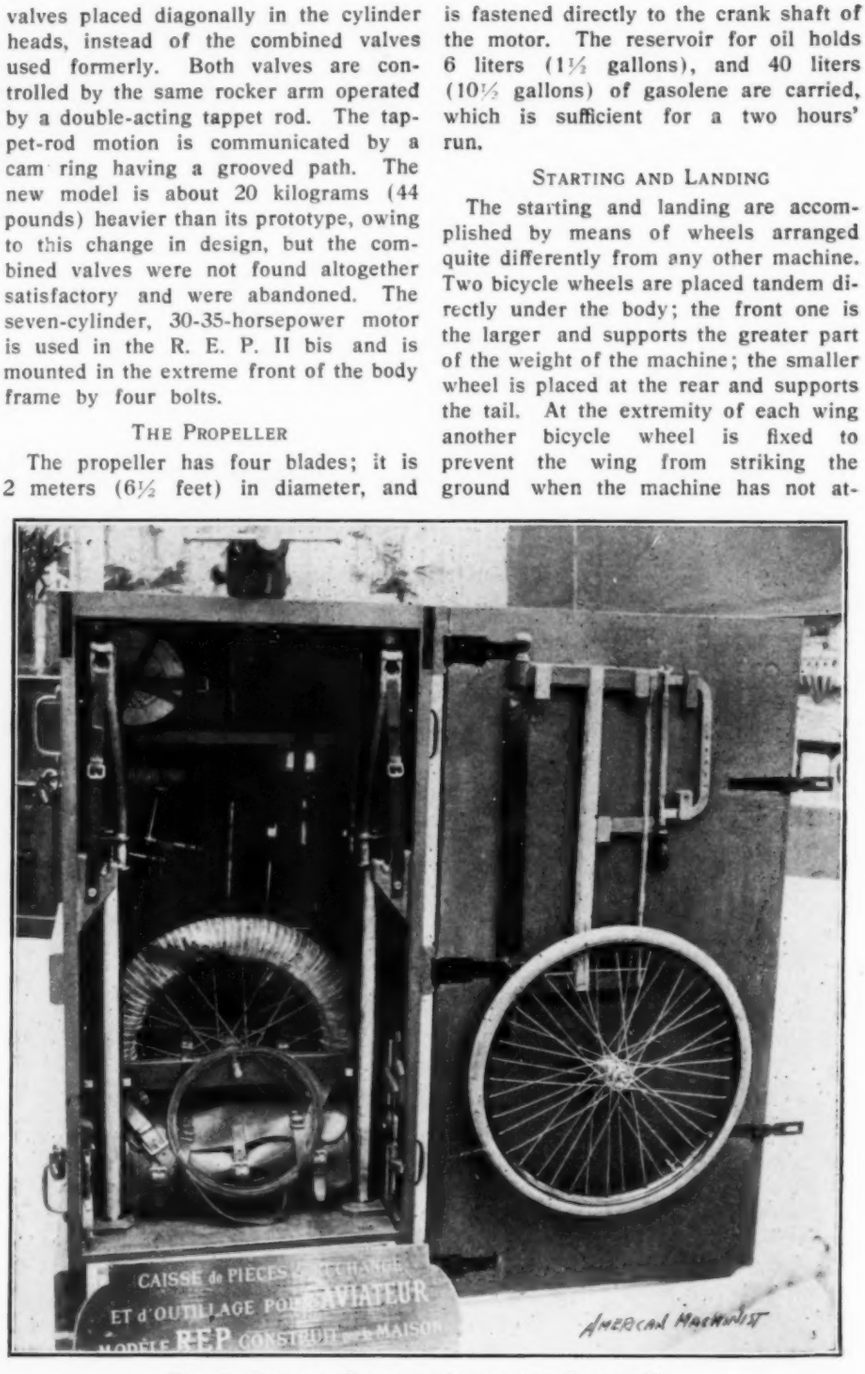



FIG. 5. ESNAULT-PELTERIE AEROPLANE REPAIR KIT

tained sufficient headway to allow it to maintain its equilibrium on the two central wheels. The large center wheel is provided with an oil, pneumatic shock-absorber, which takes up the jar when going over irregular ground and which acts more powerfully when an abrupt landing is made. The vibration caused by the roughness of the ground is absorbed by an air chamber which forms a pneumatic cushion against which a piston attached to the wheel acts; the more powerful action necessary caused by an abrupt landing is taken up by an oil shock-absorber by means of which the liquid contained in it is forced by the shock to pass through a small orifice, which gradually relieves the pressure and prevents the machine from becoming broken on its return to the ground.

Thus far, this machine has not been very successful in its public performances.

### Repair Kit

Fig. 5 shows a regular aëroplane repair kit put together by this firm. Detailed description is unnecessary, but it seems to be complete from the vise at the top, to the coil of wire at the bottom. It is of particular interest as showing the detail with which the mechanical side of aviation has developed in France. Again, it can be looked upon as the lineal descendant of the little road repair kit of bicycle days.

# Practice of Following Up Sales

*By L. L. Arnold*

One of the principal slogans of the life insurance companies is, "Our satisfied policy holders are our best advertisement"; nevertheless they keep on advertising just the same and simply use these "satisfied policy holders" when they find that they are neighbors to some good prospect. This matter is generally left entirely in the hands of the local salesman, who is no salesman at all if he hasn't "satisfied policy holders" on his list of his own production.

There is no refuting the truth of this slogan and the machine-tool manufacturer who succeeds in reproducing this method of clinching his sales, so that the main office or salesmen will be sure that any user referred to is a satisfied user, will soon find that his advertising has achieved a new power "over night."

The selling conditions are different to some extent but the result desired is the same and it certainly can be attained.

Almost every manufacturer at present has a card file of his customers indexed by States, showing name and location of customer, kind of machine, when sold, by whom sold, perhaps the price, and should have an estimate as to probable prospects. Here is the basis of his system for following up sales.

### The Machine Report

These cards should have a blank space following the word "reported," into which could be written the reference number corresponding to the "report" in a vertical letter file. These reports being filled out by the follow-up man and mailed to the main office daily, would serve to keep a general check on the man or men and the report form could be made to cover almost any information desired by the manufacturer, as to the uses to which the tool is being applied and the results attained.

If the follow-up man should find that a tool or machine was not giving satisfaction, he could rectify the trouble and explain in detail, in a space provided in the report, just why it was not giving satisfaction on his arrival, and thus any inherent weakness in the machine, should such exist, could be rectified.

Any index card showing the sale as "reported" could be depended upon as a reference and perhaps for a demonstration.

Much good advertising matter could be collected from these reports, showing results attained in various shops, of course, by permission of the management should details encroach on personal rights.

Sales could be grouped and routed so the follow-up man could do the most work with the least expense and loss of time and ofttimes he might be able to suggest some prospects not already reached by virtue of his many friends and acquaintances.

Perhaps he might be denied admittance to some shops; in which case their value as a reference would amount to very little anyway, because shop owners or managers who are so conservative (?) are generally equally so when asked questions relating to the success or failure of tools in their shops. In these cases the "reported" blank had best remain blank—it's much safer.

### The Follow-up Man

Suppose a manufacturer of grinding wheels should send out men to follow-up his wheels, not on single orders—he couldn't afford to—but to prominent cities and their outlying towns where the record of sales showed wheels to be in use; allow these men to have at their central base a sufficient variety of wheels to meet all conditions of demonstration, and then have them be sure that in every shop they visited the wheels used were those best adapted for the work and that the operator and perhaps the foreman understood why. How much chance would there be of those shops or operators desiring to change makes of wheels?

One important point must be borne in mind, however: This is no fat job for the prodigal son or favored nephew, and the manufacturer in his selection of his follow-up man decides then and there the success or failure of the scheme.

The man must necessarily be efficient mechanically; have the ability to approach men of high and low degree in a pleasing manner; be able to impart his knowledge without being offensively patronizing; and above all things be observant and able to reason out the cause and effect of new or strange conditions.

He should never be allowed to receive an order for new material as his strongest argument for attention will be the fact that he is no salesman and is going through life with the single purpose of securing the best attainable results from the machines while working under varying shop conditions.

Numerous examples of misused or unused machines and tools could be cited, but it is hardly worth while to take up space here with their recital, as every manufacturer and almost everyone else who goes through life with his eyes open could probably describe as many.

It is because it is practically impossible to find a shop that does not contain examples, that this subject of following up sales has attained its importance.

# Development of Single Purpose Tools for Railroad Shops

Those who remember the railroad shop of the old days, with its few machine tools of ancient lineage and small capacity, can scarcely fail to be impressed with the development that has taken place within the last few years.

It is also interesting to note that this development has been very largely along the line of single-purpose tools. This was, of course, almost necessary with such machines as the wheel lathe and the quartering machine, but it has been materially extended until it includes such machines as the rod-milling machine, the frog and switch planer, the frame slotter and driller, and similar tools.

It is not usual to find such a machine as a heavy miller built specially for one job in any other kind of work, or a planer so designed as to be able to handle one particular job, and yet it is a step in the right direction and credit should be given the railroad shops for it.

# Diagram for Area of Segment *By L. I. Hewes and H. L. Seward*

While there are tables published for obtaining the areas of segments of circles, it may safely be stated that few, if any of these, which are in useful form, have been obtained from an exact formula. Practically all of them are approximate.

In the accompanying cut is illustrated a diagram which, when the radius of the circle, and the ratio of the hight of the segment to the radius of the circle are known, the area of the segment may be at once obtained by the use of a straight edge laid upon the diagram. The exact formula for the area is as given on this chart and also the directions for use are there shown, together with three examples which will illustrate the method.

Unlike most devices for areas of segments, it will be seen that the chart applies to segments greater than a semicircle; in fact, one of the examples shows the obtaining of the area of a semi-circle and the third example shows the limiting case where the segment becomes equal to the entire area of the circle.

It is believed that this chart will be of considerable interest and usefulness to those desiring some quick and simple method of obtaining such areas.

# Machining the Arm Seats in Flywheels *By J. T. Towlson*

Not all shops are equipped with just the machine tools which we would choose for the purpose of performing various operations on engine and machine details as they come along, and the man who is charged with the mission to see any particular job through has to resort to various expedients, and in the interests of his employer and for his own credit, to make the best possible use of the plant at his disposal.

I once heard a clever engineer say, "Give me a lathe and a shaper, and, with rigs and jigs I will do anything in the machining line," and it is remarkable how far he was right.

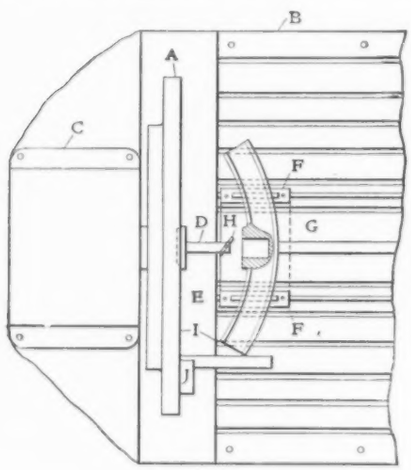



FIG. 1.
Boring Arm-Seats in Segments.

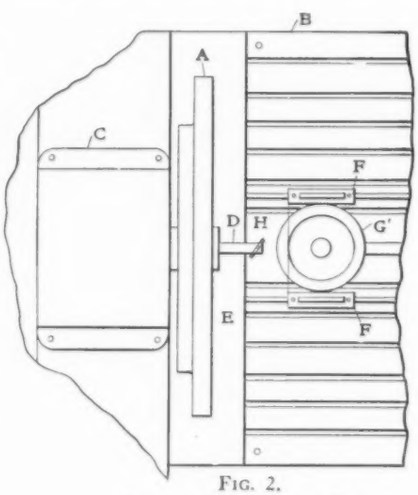



FIG. 2.
Boring Arm-Seats in Boss.
*American Machinist*

MACHINING THE ARM SEATS ON FLYWHEELS

An instance is given in the following: In a small shop some half a dozen engines came along; they were compound condensing, with cylinders 22 inches and 36 inches by 50 inches, and requiring flywheels 14 feet in diameter. These wheels weighed about fourteen tons and were made up with eight segments, eight arms and a boss.

We had no slotter, millers, nor boring machine. The ends of the segments were faced off, on a small planer, by fixing the segments on brackets attached to the planer bed, and carrying the tool and rest on the planer table. The large keyways were chipped out and finished by filing, and were finished flat and true, quite equal to any machine job. For boring the arm seats in the segments, and in the boss, we made use of a heavy face-plate lathe, which did the job finely and with little cost for tools.

Fig. 1 illustrates the method of boring the arm seats in the 48 segments, while Fig. 2 shows the lathe prepared for boring the 48 arm seats in the flywheel bosses. *A* is the face-plate; *B*, the bed plate; *C*, the headstock; *D* is a tool bar with locating hub; *E* is the pit, and *FF* are girders carrying the heavy compound rest. *G* represents the segment to be bored while *G'* is the boss. *H* is the boring tool; *II* are pin gages for setting the segments parallel with the face plate, while *J* is a square by which the segment is centered from the circular grooves in the plate.

To bore the segments it was only necessary to bolt them on the heavy tool base of the top rest, level it with a surface block, set it true with the pin gages and square and feed up the segment with the top rest toward the tool *H*.

To bore the six bosses for the arm seats, upon finding the tool base of the top rest much too high, we removed the top rest, placed the bottom slide at right angles with the face plate and fixed a casting where the top rest was taken off. This casting was provided with a post which was made to fit the main bore of the flywheel boss, with a face the correct hight, on which to seat the flywheel boss.

Having this post or guide correctly centered with the lathe for the first boss, it was correctly placed for all of the arm seat bores. It was only necessary to line off the bosses, step out the arm seat bores and strike setting circles therefor.

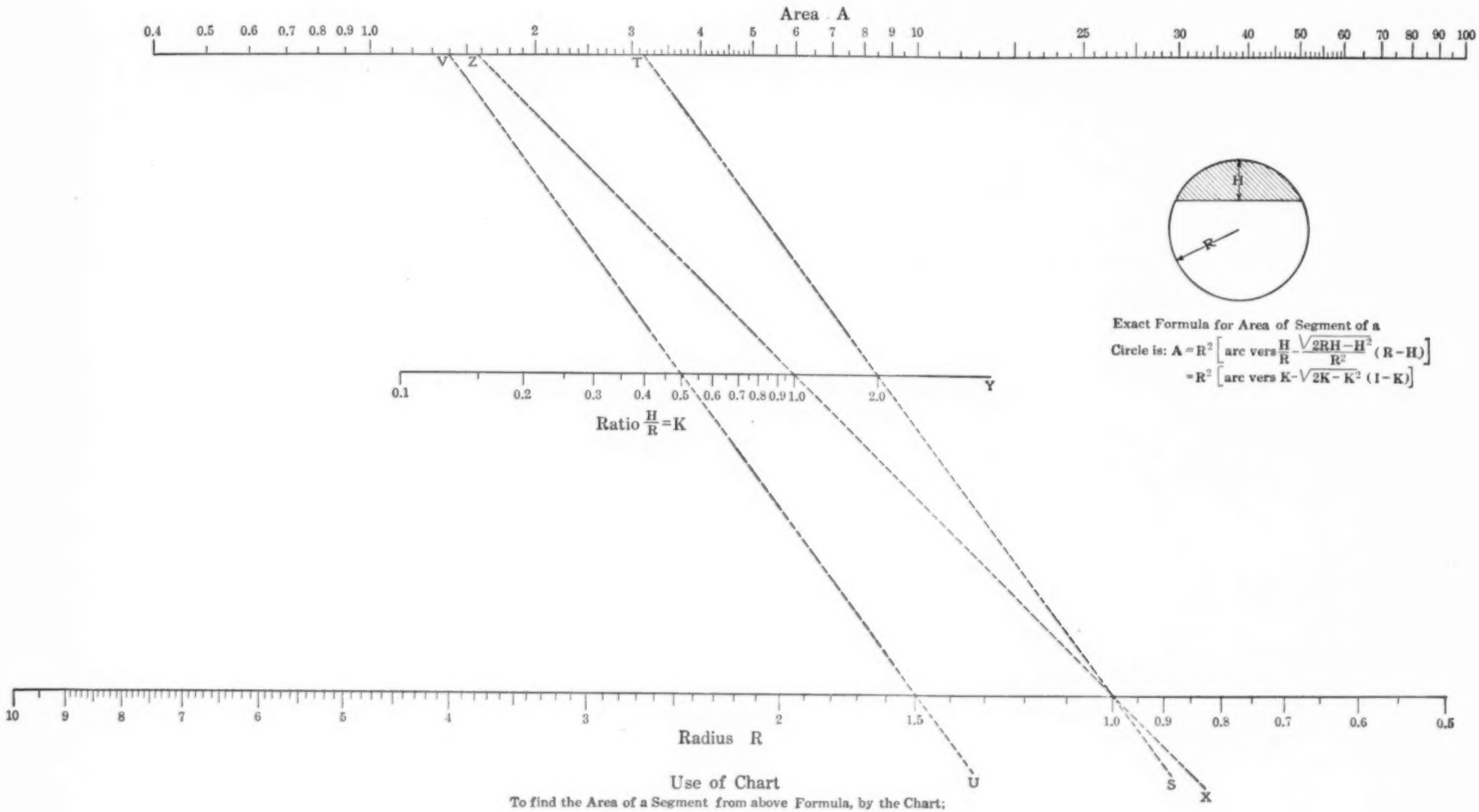
This method of machining the arm seats was most successful, the boring tool having an excess of power behind it, while the method of fixing on the heavy rest was substantial; the job was done in quick time, and the method was applied for all future jobs which came along.

London, England. J. T. TOWLSON.

## Western Electric Pensions

In March, 1903, the Western Electric Company set aside $400,000 out of profits as a permanent fund for a system of pensions, and later $150,000 was added with the further provision $150,000 might be added to the fund in subsequent years. The fund, with accrued interest, now totals $597,500.

All employees who have reached the age of 60 and have been in the company's service 20 consecutive years are eligible to the pension privileges, whether able to work or not, and are not debarred from going into other business if they accept the pension privileges. Employees who have been 30 years in service or who have reached the age of 55 and been 25 years in service may on recommendation of the president be granted a pension allowance. Any employee who has been 10 years in service and through injury or sickness has been incapacitated from work, may receive aid from the fund at the discretion of the pension board.







Exact Formula for Area of Segment of a Circle is: $A = R^2\left[\text{arc vers}\frac{H}{R} - \frac{\sqrt{2RH-H^2}}{R^2}(R-H)\right]$

$= R^2\left[\text{arc vers } K - \sqrt{2K-K^2}\,(1-K)\right]$

## Use of Chart

To find the Area of a Segment from above Formula, by the Chart;

Find the Ratio $\frac{H}{R}$, or K. Draw a Straight Line from R to K and continue it until it crosses the Scale A.

Example 1. Let R = 1.5" and $\frac{H}{R}$, or K = 0.5. Draw Line U V. Area of Segment is 1.39 Square Inches.

Example 2. Let R = 1.0" and $\frac{H}{R}$, or K = 1. Draw Line X Z. Area of Segment will be a Semicircle and is 1.57 Square Inches.

Example 3. Let R = 1.0" and $\frac{H}{R}$, or K = 2. Draw Line S T. In this case Segment will be the whole Circle, or 3.14 Square Inches.

American Machinist

CHART FOR AREA OF A SEGMENT OF A CIRCLE BY EXACT FORMULA

# Letters from Practical Men

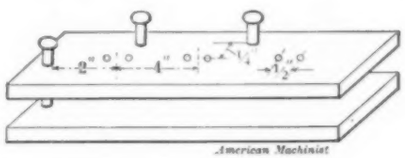
Concerning the Details of Making Things in Machine Shops from the First Sketch to the Sale

## Binding Magazines at Home

There are magazines of such a nature that after they are a few weeks old there is little chance of their being ever referred to again. The AMERICAN MACHINIST is not in that class, however, and although the subscriber does not wish to destroy them, he may not care to spend the money necessary to have them bound in fancy style. Neither does he consider it wise to clip out the articles which happen to interest him most at the particular time with the idea of putting them in a scrap book or clipping file, because he knows that many of the articles he may not even care to read at the time will perhaps at some later date be just exactly what he is looking for in connection with some new job.

For some time I have made it a practice to do my own binding in the following easy way:

About once a year, usually near the beginning of the new year, I sort out the numbers according to date, making sure




JIG FOR PIERCING MAGAZINE FOR BINDING

that none are missing, and then tear off the advertising pages, with the exception of those at the front of the first number and the back of the last one. They not only make good fly leaves as a protection for the inner ones, but quite often are of interest at some later date. It should, perhaps be mentioned that the small wire staples are also removed.

The next step is to make a simple jig, as shown in the sketch. The upper board is free to slide on the nails, which also serve as the locating pins. The three pairs of holes are placed about ¼ inch away from the row of locating pins and approximately four inches apart, while the first one is perhaps two inches from the end nail or locating pin. The holes of each pair should be ½ inch apart and made, through the upper board only, with the same awl that will be used for piercing the magazines to be bound. The above spacing will allow for three staples in the larger magazines, such as AMERICAN MACHINIST and two, all that are needed on the smaller sized ones.

Proceed by taking the first few issues of the magazine, or enough to make a thickness of perhaps ¼ inch, lift the top board of the jig and place the sheets in with the first pages facing up. The back and lower edges, which have first been evened up by tapping them on the table a few times, are placed against the locating nails or pins and the top board is then securely held down with one hand while with the other holding the awl, the entire thickness of paper is pierced. Care in first making the jig should be taken to see that the end locating the nail is at the lower edge of the sheet, for if the upper edge is used as a guide, the lower edge of the bound volume will be quite irregular and make it difficult to properly set the book on a shelf.

As each section is completely pierced, it should be threaded onto soft iron- or copper-wire staples, otherwise the various leaves may shift with respect to each other and necessitate threading on a few pages at a time. After the entire volume is assembled, the back should be tightly compressed while the staple ends are cut off about ½ inch long and bent over. It is needless to try threading the wire through in the direction opposite from that in which the awl passes, as the bur formed as the awl passes through each sheet will catch the end of the wires instead of guiding them on through.

If desired, strips of heavy pasteboard may be bound in on either side of the back and will help to prevent the outer leaves from tearing off the wires so easily: If one cares to go to the trouble, backs may be added if straps of cloth, to which the back may be glued, are bound around the back and held under each end of the staples.

This method is certainly cheap and easy and will be found quite an improvement over trying to keep the loose numbers for any length of time.

Racine, Wis. MEROWE.

## A Rig for Turning Umbrella Fittings

Figs. 1 and 2 show a familiar umbrella fitting for anchoring the stretchers, or

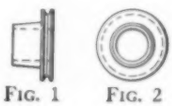


FIG. 1 FIG. 2

FIG. 3 FIG. 4

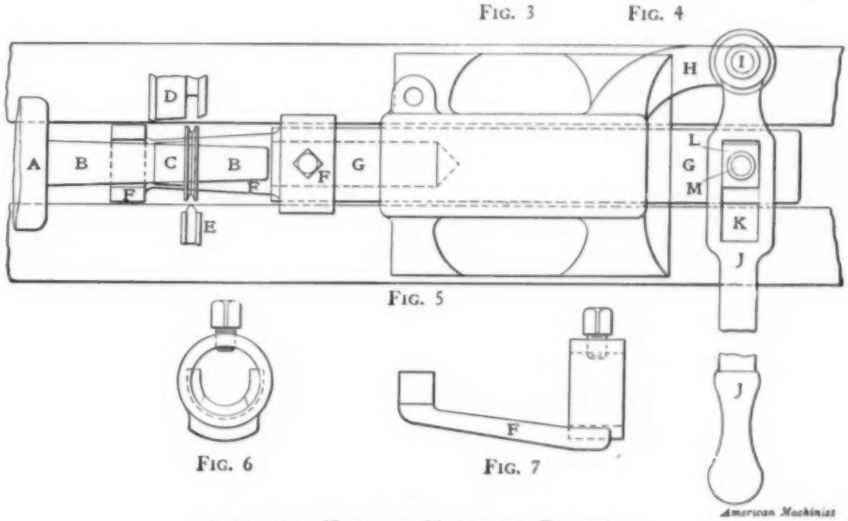



FIG. 5



FIG. 6



FIG. 7

A RIG FOR TURNING UMBRELLA FITTINGS

These fittings are sometimes made of castings, consisting of a soft yellow brass, and sometimes of stampings, made from the sheet. They are bored very slightly taper, by gripping them in a pair of pliers with special jaws and holding them by hand on a revolving reamer. They are turned, grooved and faced in the manner shown at Fig. 5. *A* shows a nose screwed onto an old 12-inch lathe spindle which holds the taper mandrel *B*. *C* is the work in position on the mandrel. The chief point of interest lies in the manner in which it is driven on and knocked off the rotating mandrel without stopping the

lathe. This is accomplished in the following manner: The tailstock is of the lever type as shown, *H* being an arm for carrying the pivot pin *I*, which supports the lever *J*, which has a slot *K*. *L* is a brass block, and *M* the stud for connecting the tail spindle *G* to the operating lever *J*. *F* is a malleable casting, also shown in end view at Fig. 6, and side elevation at Fig. 7, it is secured to *G* by the set screw shown. Figs. 3 and 4 show an adjustable gray-iron strap which is slid on *G* at the back end and forms a stop.

The work is slipped on the mandrel by hand, the lever *J* pulled, and the end of the barrel *G* forces the ferrules tight on the mandrel, until the stop, Figs. 3 and 4, comes into operation. The two circular forming tools *D* and *E* are then brought up to the work by the cross-slide lever until the stops are reached. When the work is completed the backward stroke of the handle *J* pulls the work off the mandrel by the two horns on the end of *F* coming in contact with the grooved collar on the work.

The cost at which the operation complete can be performed is really surprising. A girl can turn from 400 to 500 per hour.

Sheffield, England. J. GRAYSON.

## Shaping the Teeth of Internal Gears and the Toothed Taper Hole in Shifter Fingers for Automobiles

The halftones and line cut show a fixture designed by Mr. Lipe, of the Brown-

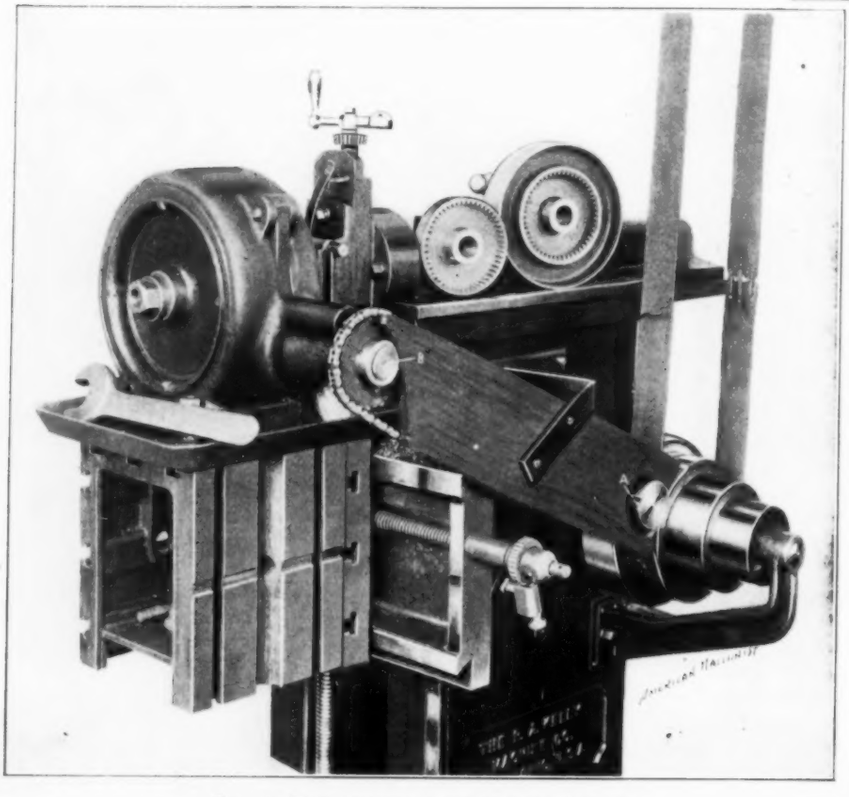


FIG. 1. THE DRIVING SIDE OF THE FIXTURE

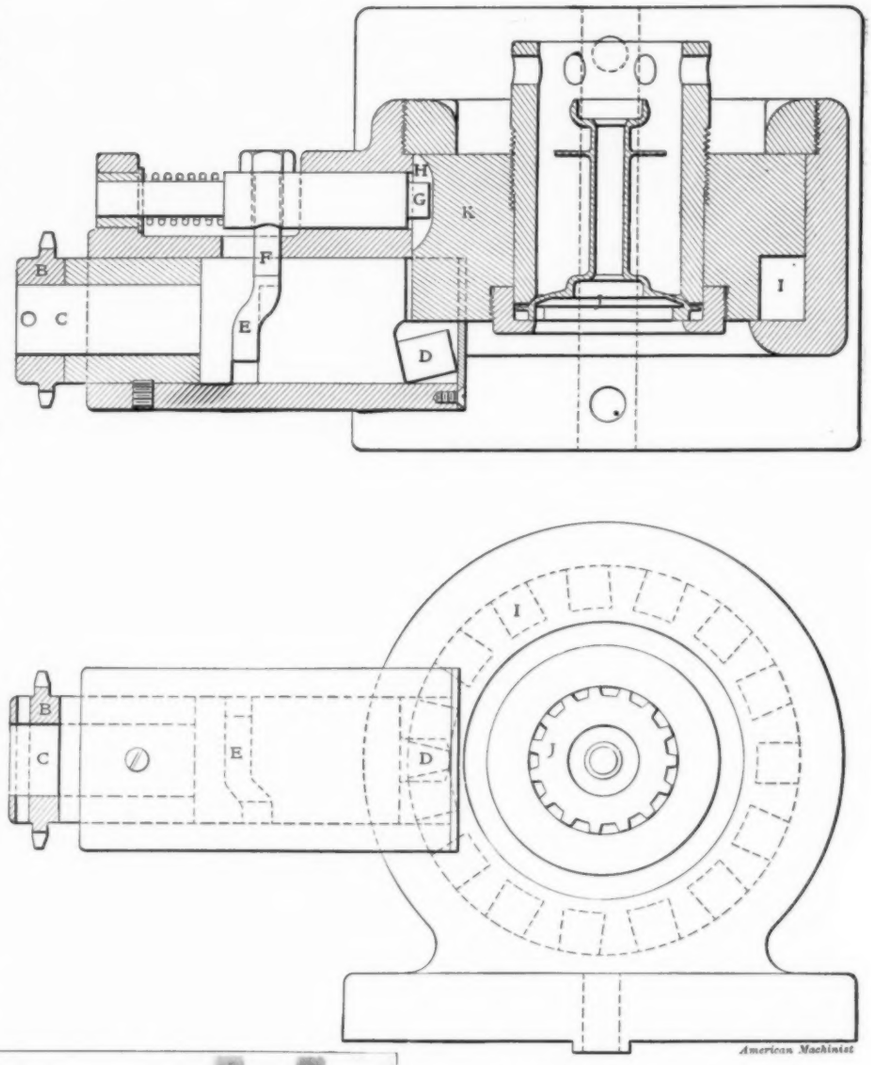



FIG. 2. DETAILS OF THE FIXTURE

Lipe Gear Company, Syracuse, N. Y., for shaping internal work used in automobile transmissions, etc. Fig. 1 shows the fixture mounted on a Kelly shaper. Mounted on the main shaft *A* of the

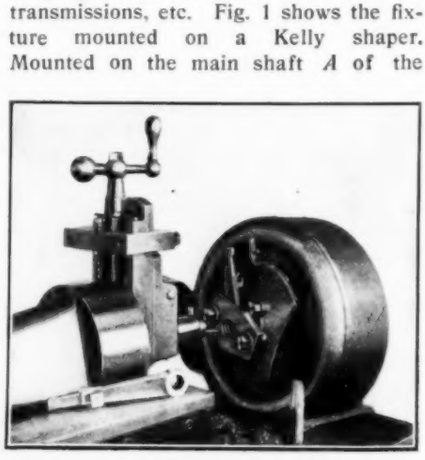


**FIG. 3. SHAPING INTERNAL TEETH IN SHIFTER FINGERS**

shaper is a sprocket wheel which, through a chain, drives a sprocket of the same size mounted on the shaft *B* of the fixture.

The line cut, Fig. 2, shows the internal arrangement of the fixture. The driving

sprocket *B* is mounted on the shaft *C*. At the other end of the shaft *C* a single pin-like tooth *D* is formed, which meshes with the rectangular slots *I* in the rotating part *K* of the fixture. Formed on the body of the shaft *C* is a cam slot *E*, which through the pin *F* actuates the locking pin *G*, which engages the locking slots *H* in *K*. The fixture is so timed that the indexing occurs as soon as the tool leaves the work on its return stroke.

In Fig. 1, alongside of the ram are shown two internal gears shaped on the fixture. In Fig. 3 are shown two shifter fingers, one in the jig in the fixture and one alongside the head. The holes in these are tapered and the fixture is consequently tilted so as to obtain this result. In front of the fixture in Fig. 3 is shown the gage for these holes. The output is about 50 complete fingers per 10-hour day.

New York. E. M. BAIN.

## An Improved Tap for Pipe Fittings

Figs. 1 and 2 show a tap made for tapping malleable-iron fittings. It was made with 16 threads to the inch and had a taper of 1¼ inches to the foot.

The castings for which the tap was

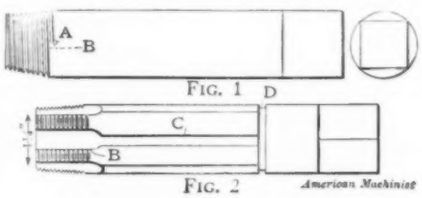



FIG. 1 FIG. 2

AN IMPROVED TAP FOR FITTINGS

made have six holes in a circle. These castings are rights and lefts, that is, they are tapped right and left hand. The tubes going into them are, of course, threaded right and left hand. The six tubes are started first in the left-hand holes, one turn on each tube. The right-hand casting is then put in place and the tubes are started in their respective holes in it.

The ordinary pipe tap leaves a thin thread at the outside of the hole, which is apt to get turned over and cause trouble when screwing the pipes in.

Fig. 1 shows the blank for the improved tap. A hole was drilled at *A* for the thread to run into.

When the thread was finished, the cutting edge of one of the grooves was spaced to come at *B* so that when the tap was run in to full depth a *full* thread was left at the front of the casting. This full thread is sometimes called a "Higby" thread, the reverse of it is often formed on the end of lathe spindles so as to push any dirt ahead that may be lodged in chuck or face-plate threads.

In tapping, the tap is run about ⅛ inch past the last thread on it, counterbalancing the casting and leaving a square end on the last thread. With the castings finished in this way, the tubes enter readily. *C* is a ¼-inch, half-round oil groove. *D* is a groove for the pawl to engage in to hold the tap in the machine.

Elmira, N. Y. J. C. DAWSON.

## Rolling Threads in a Turret Lathe

This method of threading work is quite satisfactory, where the pitch is not too coarse and the diameter not too small. Not long ago we had an order for some small brass tips like the sketch, Fig. 1.

These were to be made from 1-inch diameter rod brass, and it will be seen that the thread is in such a position that

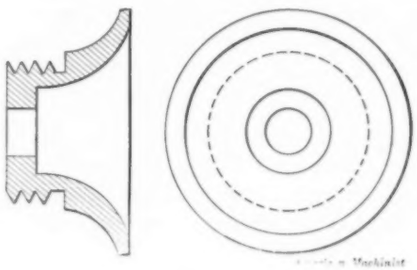


FIG. 1. THE THREADED WORK

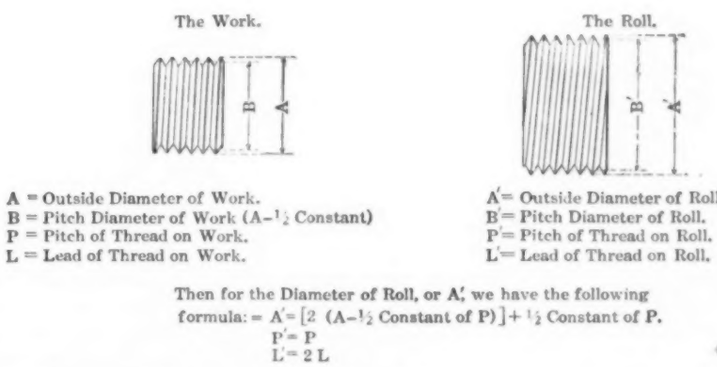

The Work.
B
A
The Roll.
B
A
A = Outside Diameter of Work.
B = Pitch Diameter of Work (A–½ Constant)
P = Pitch of Thread on Work.
L = Lead of Thread on Work.
A′= Outside Diameter of Roll.
B′= Pitch Diameter of Roll.
P′= Pitch of Thread on Roll.
L′= Lead of Thread on Roll.
Then for the Diameter of Roll, or A′, we have the following formula: = A′= [2 (A–½ Constant of P)]+ ½ Constant of P.
P′= P
L′= 2 L

FIG. 2. DIAGRAM OF WORK AND ROLL WITH FORMULA FOR ROLL DIAMETER

if cut with a die, it would be necessary for a second operation to complete it. We at once saw that by rolling this thread, we could finish the piece complete before cutting from the bar.

The roll and forming tool were made and the piece was finished in the following manner: First, it was formed with the forming tool held in the cutoff slide; second, it was drilled and bored with a tool held in the turret, then the thread was rolled, the roll being held in the opposite tool post of the cutoff slide, and last, it was cut off with a special cutoff tool held in the turret. This method of finishing proved very satisfactory and was quite rapid.

The thread on the work was 24 pitch, sharp V, while the thread on the roll was 12, cut double. This, at first, may seem strange to some, but the pitch circumference of the roll was of such length that it made one turn to two turns of the work. This explains the difference in the lead of threads.

We have used the formula under sketch, Fig. 2, with success, for obtaining the diameter of the roll.

These rolls may have a pitch diameter three times the pitch diameter of the work, by threading them with a lead three times the lead of the thread on the work, or if the work is of a large enough diameter, the roll may be made with the pitch diameter equaling the pitch diameter of the work.

Such rolls, of course, can be made a great deal cheaper than a die, or set of chasers for a die head, and may be used either in a tool post on the cutoff slide being brought up to the work and fed to a stop, or held in a special holder, passing under the work, this necessitating the roll being set at an angle equaling the tangent of the angle of the thread.

Peoria, Ill. SAM KINSEY, JR.

## Cold Water Annealing

A correspondent calls attention to the old method of cold-water annealing reported to be highly successful on the common grades of steel. It is to heat the steel to a dull red and then holding it in a dark place until the red disappears and the steel turns black. The steel is then dipped in cold water and can be easily filed. Of course, this method can only be used where it is desired to anneal the end of the piece, as it would be difficult to cool the work evenly. For small profile machine cutters, etc., it is very handy because waiting is unnecessary.

Another way of testing the "dipping" heat is to allow the piece to cool gradually, at the same time rubbing the steel with a piece of dry white pine. When the steel is nearly cool enough to dip, small particles of charred wood will rub off, stick to the steel and glow momentarily. When the action ceases dip.

# Discussion of the Previous Question

**Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers**

## Arithmetical Proofs

There has been so much in your paper about the "Rule of 9" and its usefulness in checking up additions, subtractions and multiplications, that it is a wonder no one has sprung the "Rule of 11," which is more convenient and practical. The rule of 11 is based on a check number found by dividing any amount by 11, the amount left over being the check number. If this left over amount is a multiple of 11, the check number is 0, no matter how many times 11 is contained in it. It will be evident that these check numbers vary from 0 to 10, as any amount can be reduced to one of these denominations. Ten is written X, the Roman symbol for it, to maintain single figures in the check number. As it would take too long to divide each amount by 11, a simpler way to find the check number, which is the amount left over, is used.

This rule may seem hard at first, but is easily mastered, especially by one used to figures and mental arithmetic. In finding the check number of any figure, begin at the right hand; subtract the tens, thousands, hundred thousands, etc., from the units, hundreds, ten thousands, millions, etc. Another way to put it, is; beginning at the right hand of the number, take the sum of the second, fourth, sixth, eighth, etc.; or the even digits, from the sum of the first, third, fifth, seventh, etc., or the odd digits. Always find the subtrahend first, then find the minuend, and the remainder is the check number. If this remainder is greater than 11, it can be reduced to its least denomination in the same way. If the subtrahend is greater than the minuend, add 11, or a large enough multiple of 11, to the latter; subtract, and the remainder is the check number.

For an example, take the multiplication on page 607, Volume 33, Part 1, $2854 \times 3271 = 9{,}335{,}434$. Beginning at the right of 2854, we subtract the tens and thousands, 5 plus 2, from the units and hundreds, 4 plus 8; or 7 from 12 equals 5, the check number of 2854. Now take 3271 and add 7 plus 3 to get X (10), the subtrahend. This cannot be deducted from 1 plus 2, the minuend, so add 11 to the latter, and we have; X (10) from 3 plus 11 equals 14, or a check number of 4. Multiply these check numbers to prove the multiplication; $5 \times 4$ is 20, which reduces to 9, as 2 must be deducted from 0 which, as said above, is the same as 11. Then find the check number of the product above, 9,335,434; subtract 3 plus 5 plus 3, or 11 (which is 0), from 4 plus 4 plus 3 plus 9, which is 20, or as shown above, 9. This corresponds to the 9 just obtained by multiplying the check numbers of the multiplicand and multiplier.

Printed out it looks very complicated, but with a little practice these check numbers can be found very quickly. For instance, I can see at a glance that 4, 4 and 3, the subtrahend, would cancel 3, 5 and 3, leaving 9 as the check number.

The most practical use for this check is in bookkeeping. It is not a system of bookkeeping, but if properly used, it is a check on all transfers, and can be used with any system, where there is not already a better way of proving postings, etc. Remember that the check of the sum must equal the sum of the checks. Take a lot of figures, as in a sales book; add them up and put down the check number of the sum. In transferring the different amounts to the ledger, place the check number of each opposite it in the ledger, and carry this check number back to the salesbook, also placing it opposite to its amount, convenient for adding and carrying forward. Be sure to carry the check number you set down in your ledger opposite to item in salesbook, and do not try to compute it twice.

When all items are posted, if the work has been done correctly, the sum of the check numbers will equal the check of the sum, proving the posting and the addition of the salesbook. This must be carried through all the postings to the ledger, whether debit or credit. In adding up balances on the ledger, again the sum of all entries posted can be checked, as the sum of the check numbers opposite each item must equal the check number of the sum. In taking off credits, the subtraction is checked in the same way, the check number of the balance being carried to the trial balance, where proof of addition can be made by adding up these check numbers. In carrying balances from one page to another, just forward the check number with it, and no mistake can occur without its detection when balance is struck.

If the right amount is carried to the ledger from the sales book, but the wrong check number should be set down, it is evident that this wrong check number being carried back to the sales book, the error will show in the addition on the salesbook. If the wrong amount is carried to ledger, the wrong check number will be deduced and carried back to salesbook, where the error will again show on the salesbook addition. This will be seen to be an automatic check on all postings and transfers, if properly used, and while it does not eliminate errors, it will finally point to the exact account on which the error was made. With a little practice, one gets to feel a security about his work and can do it in about half the time required where no checking system is used and care is taken to exclude errors. Besides this, it checks all additions by merely adding a single column of figures. The beauty about it is that the error shows on the very account, and on the very invoice of that account where error was made, provided the error ever gets to the ledger. Most of them show up on the addition of the books of original entry.

This rule is not good for checking division. Also while the rule is mathematically correct, there are some chances of error that would not be discovered by the check number. For instance, the check number for 0.60 is the same as for 60.00; for 6.00 it is the same as for 600.00. It will catch ordinary transposition of figures, but will not catch an error if two even or two odd numbers are transposed, but this is an error seldom made. The saving in time is accomplished by having the hand and mind work at the same time. For example; in posting, the mind takes cognizance of an amount on the salesbook, carries it, and the hand enters it on the ledger. While this is being done, the mental operation of finding the check number takes place and by the time the entry is made, the check number is ready to be jotted down in the ledger. When going back to get the next posting from the salesbook, this check number is carried back and placed in salesbook just opposite the amount posted, and the operation is repeated until all postings are made.

The only errors that can occur, without the check showing them automatically, are where the correct amount, and the amount posted in error, have the same check number.

If I had to keep a big set of books, without an adding machine, I would not part with the use of this rule for a good many hundred dollars, and I need the money too.

A. M. WATCHER, SECY.-TREAS.
Queen City Machine Tool Company.
Cincinnati, O.

## Machining Half Bearings

I have read with interest the article by C. S., "Machining Half Bearings" on page 1140, Part 2, Volume 32. Now having been up against the same problem myself, perhaps the method I adopted of producing similar pieces will be of interest to C. S. and others.

I made metal patterns to obtain clean castings as near to size as possible. On arrival from the foundry they are pickled to soften the skin.

They are next taken to a disk grinding machine to have the faces $A\,A_1$ ground straight and flat to a certain hight from the back. After this they are taken to the lathe and held in a chuck, Figs. 1 and 2, for boring and facing.

The chuck itself is a cylindrical iron casting which is bolted by three bolts on to the face plate, and is self setting by the spigot $S$ which is engaged by a recess in the face plate. In the center of the chuck, and from the outer end, a hole is bored so that the half bearings can be inserted.

Through the chuck and at right angles to the face plate there are two rectangular spaces cut through the body of the chuck, the edges $B\,B_1$ being on the same center line that passes through the face plate, and lathe center.

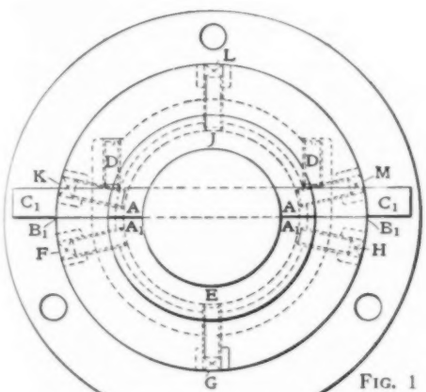


FIG. 1

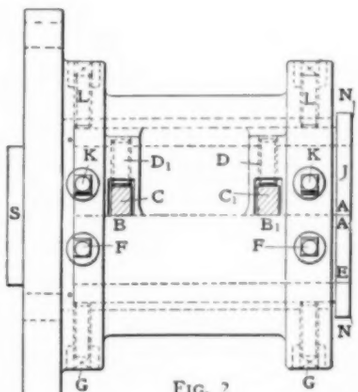


FIG. 2

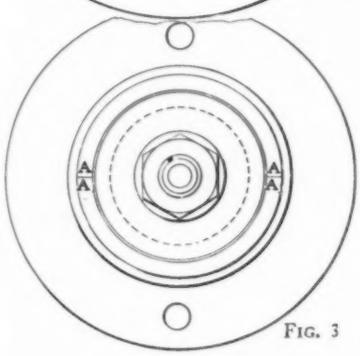


FIG. 3

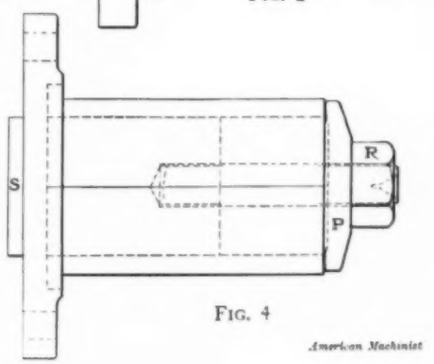


FIG. 4

MACHINING HALF BEARINGS

To set the bearings for boring two pieces of steel machined square, $C\,C_1$, Figs. 1 and 2, are passed through the chuck and pressed down on the faces $B\,B_1$ by the screws $D\,D_1$. One-half the bearing $E$ is then placed across these two pieces of steel and clamped into position by the screws $F\,G\,H$. The screws $D\,D_1$ are then loosened and the square strips $C\,C_1$ removed. The lathe is now turned half a revolution and another half bearing $J$ is placed on the top and concentric with $E$, being secured in position by the screws $K\,L\,M$. The boring, facing and reaming tools being fixed in the turret the job is now proceeded with in the usual way, the ends $N\,O$ and the flange being made to size while in the chuck.

To machine the outside of these bearings, they are mounted upon a cast-iron base plate in pairs, Figs. 3 and 4 which is also secured and centralized to the face plate by bolts and a spigot. In the front side of the plate a recess is formed, and the boss turned so that the half bearings may fit snugly, they are held in this position by the clamp plate $P$ and nut $R$, whose stud is centered so that the tailstock may be brought up to steady the job during the turning operation.

London, England. A. H. PIERCE.

## Poisonous Effects of Hardening Method

After reading the article on "Ball Bearing Center and Hardening Method" by W. D. Forbes on page 157, it occurred to me that there might be some danger attached to his hardening method due to the evolution of poisonous gases.

Mr. Forbes states in his article that the current used was heavy although not saying how heavy. The resistance of the cyanide solution would vary so much with the shape of the pot used, that one could hardly state, without measuring, just how heavy it would be. I should think, however, that it was above 100 amperes at the stated electromotive force (250 volt).

A hundred amperes would evolve in 2 seconds (the time stated by Mr. Forbes to harden the piece) 54 cubic centimeters of cyanogen gas at the anode or positive terminal. The above is calculated at atmospheric pressure and 70 degrees Fahrenheit, which is a fair average shop temperature.

This cyanogen gas may unite with the hydrogen liberated at the cathode or negative terminal due to the action of the potassium deposited by the current on the water. Whether this reaction takes place or not depends on the distance between the electrodes. Should the action take place hydrocyanic acid (prussic acid) would be formed. The ultimate result would, however, be the same for both cyanogen and prussic acid are highly poisonous. I have spoken to men in the medical profession who say that cyanogen evolved in the quantities shown above, is highly dangerous if not confined to a fume chamber.

Even were the danger slight, if more than one operation is performed at same time, or several pieces hardened one after the other, the gases might accumulate and become dangerous. It is useless, therefore, to undergo the risk when a very simple remedy may be applied.

Were an alternating current used, instead of the direct current suggested by Mr. Forbes, there would be none of these gases evolved. In this case potassium and cyanogen would be evolved successively, and in rapid succession, upon each electrode. Here they would combine and again enter into solution as potassium cyanide.

Brooklyn, N. Y. G. W. JANSON.

A structural steel contract of unusual magnitude, equaling that of the largest bridges, is to be placed by the Isthmian Canal Commission. It is for the manufacture, delivery and erection of about 58,000 tons of steel for the 46 gates of the Gatun, Pedro Miguel and Miraflores locks. These gates are from 47 feet 4 inches to 82 feet high and are constructed of steel throughout. Some idea of the magnitude of the work involved in them can be gained from the fact that if the 92 leaves could be piled one on top of the other they would make a tower 1.2 miles high. Figures of such magnitude in respect to steel work are equaled by the latest reports from the Isthmus regarding other features of the work. The total excavation for March was 3,067,479 cubic yards, place measurement.

# Making Pattern for Double Helical Bevel Gears

*By W. Wilson*

Some time ago an inquiry was received where the writer was employed, for a pair of double-helical bevel gears. The specifications were for a pair of cast gears of large pitch. While the design of such gears is not new, it is so unusual that the writer feels justified in outlining a method for their manufacture.

Double-helical bevel gears, the same as with double-helical spur gears, can be considered as made up of an infinite number of gears of differential thickness, each lamina of which has been turned through a differential angle relative to the adjacent lamina. From this it is evident that the problem does not present anything new in the way of tooth outline development.

Referring to Fig. 1, let *OA* be the axis of one gear, and *OB* the axis of the other. Then *BC* and *AC* are the radii of the imaginary pitch circles from which the outline of the teeth is determined at the outer end, the same as for any ordinary bevel gear. Also *B"C"* and *A"C"* are the radii of the pitch circles from which the outline of the teeth at the inner ends are determined. It is at this point that the difference in the shape of the teeth for the two types of gears enters. In the case of the ordinary bevel-gear tooth the elements of the tooth surface are straight lines converging into a common intersection at the vertex of the pitch surface cones. In the case of the double-helical bevel gears the elements of the tooth surfaces are helices, or rather modifications of helices, as in their case the curve results from the wrapping of a triangle about a cone rather than about a cylinder as is the case with a true helix.

Consider the gears as made up of two parts divided by the surface passing through the points where the helices change sign. It will be necessary in making the pattern or the toothblock, as the case might be, to make these two parts separately.

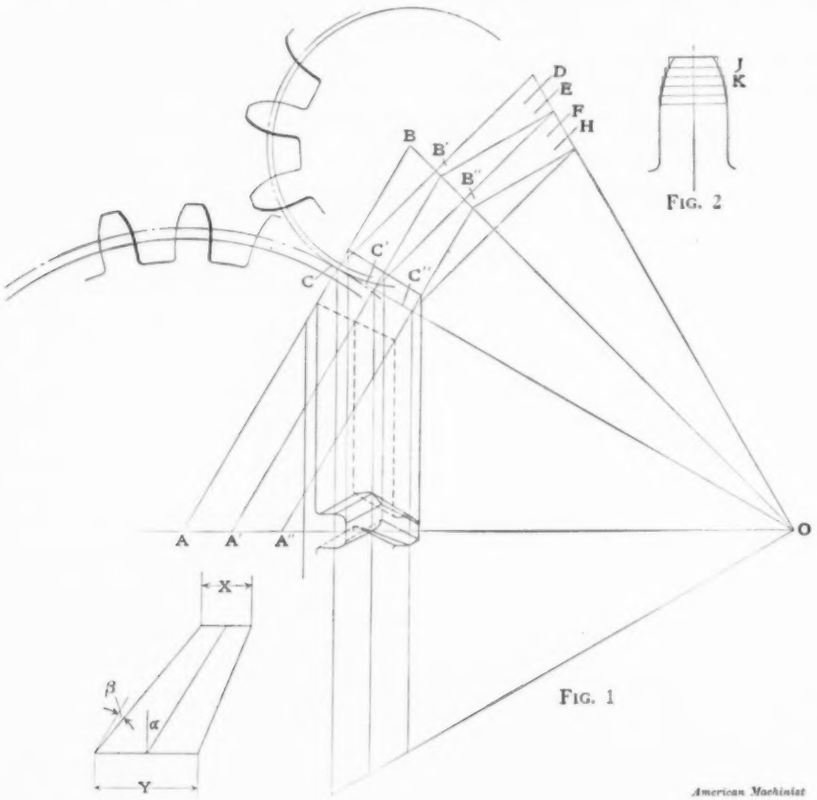



FIG. 1




FIG. 2

FIG. 3

PATTERN FOR DOUBLE HELICAL BEVEL GEARS

Consider the outer portion: It is desired to make this portion of the pattern. First make a blank cone (frustrum) which will just circumscribe the finished teeth. Lay off on this surface a helix of the required pitch. Through the terminals of this helix draw radial lines on the faces of the frustrum of the cone. These can be used as center lines of the outside and inside tooth sections. Place the templets for the tooth sections on the corresponding surfaces of the frustrum of the cone with the center line of the templets coinciding with the radial lines drawn as described above. Through the outer corners of the tooth draw helices parallel to the one already drawn. This determines the outline of the tooth at both ends and on the surface of the cone. If it is desired to give the patternmaker still further guidance in the forming of the tooth as would probably be necessary, templets could be made corresponding to tooth sections at intermediate points, such as *D*, *E*, *F*, *H*, etc. Then by having helices on the surface of the cone corresponding to the outer corners of the tooth and having provision for holding the intermediate templets in proper position, a good check upon the shape of the tooth could be obtained. This method is similar to the one used in making patterns for double-helical spur gears where they are formed by hand, except that in the latter case all parallel sections of the tooth are the same.

I wish to suggest another method for forming the teeth which, while as far as I know, has never been tried, seems quite rational. If conical surfaces having axes in common with the pitch cone and having diameters differing by a differential amount, be passed through a tooth of the gear, they would cut out a lamina which, when developed, would be a trapezoid similar to Fig. 3, in which *A B* is the center line of the trapezoid. In this figure $\alpha$ depends upon the angle helix, and $\beta$ upon the bevel of the gear, while $x$ and $y$ are the widths of the tooth on the inner and outer surfaces of the frustrum, and at the inside surface of the lamina. If, then, a number of trapezoids could be made of thin, flexible wood, or other substance, with the different values of $\alpha$, $\beta$, $x$ and $y$ corresponding to the successive laminas of the tooth, and placed one upon another upon the surface of a cone corresponding to the base of the tooth, the bottom edges of these trapezoids would form elements of the required tooth surface and would furnish sufficient guide for forming the tooth. A section of such a tooth before it was formed would be as shown in Fig. 2, in which *J*, *K*, etc., are arcs of circles. This same method might be applied in making patterns for double-helical spur gears.

In any case, the making of a pattern for a double-helical bevel gear would be very expensive, and only warranted in a few special cases.

By making the point where the helices change sign in the proper position, the algebraic sum of the axial thrusts due to the spiral shape of the teeth could be made to just offset the axial thrust due to the bevel of the gears. While I have seen no description of it, I understand that this principle has been made use of in the design of a spiral bevel (single helical) in which the pitch of the spiral has been made of such magnitude as to cause the axial thrust due

to the spiral and to the bevel to just offset each other. These gears are machined by a special machine built for the purpose and like the larger cast gears, must of necessity be very expensive unless made in considerable quantities.

In the case of the cast bevels as described above, a pattern could be used only in cases where the base of the tooth was comparatively wide, so as to allow of the drawing of the pattern. This eliminates involute tooth outlines except where the base line is at or near the base of the teeth. Otherwise it will be necessary to use a tooth block and pull the block away from the vertex of the pitch cone. In any case, however, a tooth block would be more practical because of the great expense of making a pattern.

# Apprenticeship System of the H. H. Franklin Manufacturing Co.

The H. H. Franklin Manufacturing Company, of Syracuse, N. Y., has just started an apprenticeship system, embodying a four-year course of shop work and text-book instruction.

To be eligible for entrance into these apprenticeship classes an applicant must be between the ages of 16 and 20 years and must have had a grammar-school education or its equivalent. The first 12 weeks are considered a probationary period. If the work of the pupil is satisfactory, at the end of that period he is formally accepted as an apprentice, and the length of his course is dated from the beginning of the period of trial.

Wages are graduated throughout the course, beginning with eight cents an hour and ending with 20 cents an hour. At the completion of the course a bonus of $100 is given to the boy and he is awarded a diploma.

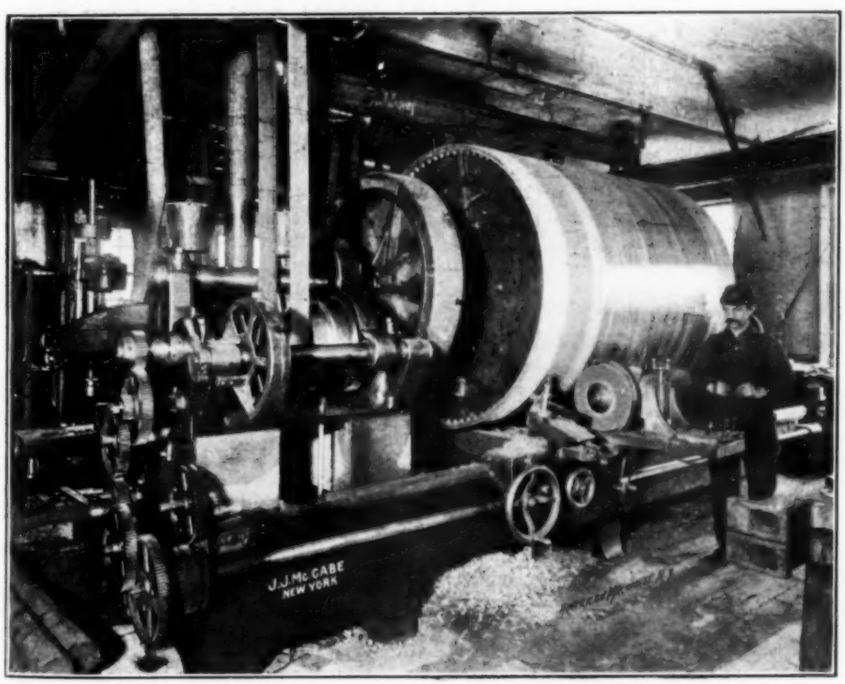
At all times he is under the supervision of an instructor, who as far as possible, will look after the boys when they are outside of the plant. The entire course consists of 10,800 hours, or 2700 working hours per year, for four years.

The shop instruction is substantially as indicated by the following tabulation: First year—Drilling, 10 weeks; milling, 24 weeks; lathe work, 16 weeks. Second year—Lathe work, 10 weeks; bench, 12 weeks; J and L, 8 weeks; gear shaper, 8 weeks; auto screw machine, 12 weeks. Third year—Grinding, 8 weeks; tool work, 18 weeks; erecting, 12 weeks; small assembly, 12 weeks. Fourth year—Tool drawing, 26 weeks; tool work, 24 weeks.

The text-book and class-room instruction is given in two periods of two hours each week. The course is as follows: Review of arithmetic, 10 weeks, first year; algebra, ½- to ¾-hour lessons for 40 weeks first year; plane geometry, ½- to ¾-hour lessons, for 50 weeks, second year; trigonometry, ½- to ¾-hour lessons for 25 weeks, third year; elements of machine design, ½- to ¾-hour lessons for 25 weeks, third year; elements of machine design and shop mathematics, ½- to ¾-hour lessons for 50 weeks, fourth year; mechanical drawing, 1½-hour lessons for first two years; analysis of the different machines, 1½-hour lessons for last two years; shop supervision, short course.

No form of contract is required between the company and the pupil, as it is expected that the attractiveness of the course will be sufficient to encourage the boys, if they are serious minded and ambitious to better themselves, to finish once they have begun.

# An Accurate Large Job on McCabe Double Spindle Lathe




AN ACCURATE LARGE JOB ON A McCABE LATHE

The halftone shows a job done on the McCabe double-spindle lathe, which is remarkable not only because of its size, but because of the accuracy required. It is a steel cylinder, 61¼ inches diameter, 69 inches long, and weighs about 3000 pounds. The outside is rolled to a circle and welded, after which the two ends are riveted to the shell, which, while a strong job, is rather springy under a cut. The job was put through by the Johnson, Van Vlaanderen Machine Company, Paterson, N. J. Before tackling the work, they tried to get it done outside, but there was no lathe in Paterson which could handle the job without blocking up.

The roughing cut took about 17 hours, not because that was the limit of pull of the lathe, but the cylinder being of steel plate, would not stand a heavy cut. The finishing cut took about four hours and the grinding about 18 hours. The cylinder was finished round and parallel to within a limit of 0.002 inch. Another similar cylinder is being put through by the same concern, and they expect to cut the time in half.

# Cutting Speeds for Milling Cutters

*By I. Reindl*

Since the introduction of high-speed steel, there has been a general attempt to raise the cutting speeds of the tools. In fact, high-speed steel permits cutting speeds which previously were never expected, and these in conjunction with the likewise increased feeds, have enabled a very considerable increase in the efficiency of the cutting tool. For turning and planing tools, as well as drills, the proper cutting speeds have long been determined and made known by thorough experiments. Concerning the method of using milling cutters also, there has been published matter relating, among other things, to cutting speeds. Unfortunately these meager researches have only slightly entered into practical work, and there prevails, even among experienced mechanics a great lack of clearness concerning the proper cutting speeds for milling cutters.

When it is taken into consideration that the right cutting speed for particular work is dependent upon the material that is to be machined, the cutter pitch, the cutting angle, also upon the feed, depth, and breadth of chip, etc., and not least upon the stability and good condition of the machine, it must be admitted that, with the cöoperation of so many factors, a perfectly general determination of cutting speed presents certain difficulties. Taking into account scientific investigations that have already been made, and in order to remain within the limits of a short sketch, no attempt will be made to discuss theoretically such factors as these, but only a few experiences and observations from practice will be presented. First of all, attention must be called to the inadequately distinguished cutting speeds for carbon-steel and high-speed steel cutters.

As already mentioned, there is for every cutting tool a certain velocity which, due regard being paid to the influencing factors, can be designated as the most favorable. This best speed will give the highest efficiency for the least expenditure of power. With lathe and planer tools, drills, etc., this best cutting speed, however, often lies so high that its employment for carbon-steel tools produces much heating and results in an unpermissible wear of the cutting edge. We are therefore compelled to diminish the speed for carbon steel tools, while high-speed steel tools permit greater velocities, at which they may be employed to advantage. Different cutting speeds are, therefore, appropriate for carbon and high-speed steel lathe and planer tools, drills, etc.

It is otherwise with milling cutters. For these, the best cutting speed does not lie so high as to be unavailable with carbon-steel cutters. Moreover, the heating of milling-cutter edges is less than that of the edges of lathe and similar tools, because the working period of the individual teeth is relatively short and between each cut they have time to cool off in the air as the cutter turns round. Artificial cooling by liquids will not be considered in this article, because the point of view here taken would not be essentially changed thereby. So long as there is no difference in tooth form and pitch between high-speed steel and carbon-steel cutters, a difference in the cutting speed is unwarranted, for it remains constant with these determining factors. The increase in performance only takes place through a greater feed. Nevertheless, in very many shops distinctions are made between the cutting speeds of carbon-steel and high-speed steel cutters, especially in working cast iron, and they have induced the writer to undertake the test now to be described.

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| Cutting speed, feet per minute | 19.7 | 23.9 | 29.5 | 37.7 | 45.9 | 57.4 | 70.5 | 86.9 | 106.6 |
| Cutter revolutions per minute | 21 | 26 | 33 | 41 | 50 | 62 | 76 | 94 | 115 |
| Horsepower, input to machines | 6.66 | 6.85 | 7 | 7.4 | 7.84 | 8.13 | 8.73 | 9.42 | 10.3 |
| Chips removed per horsepower per hour, pounds | 34 | 33.7 | 32.8 | 31.3 | 29.5 | 28.6 | 26.8 | 25 | 23 |

TABLE I. CUTTING SPEED CORRESPONDING TO SPINDLE REVOLUTIONS AND POUNDS OF CHIPS REMOVED PER HOUR.

| Material. | Cutting Speed in Feet per Minute. | |
|---|---|---|
| | Roughing Work About 0.156 Inch Cut. | Finishing Work About 0.02 Inch Cut. |
| Cast iron: | | |
| Soft | 39–49 | 59–65 |
| Medium hard | 29–39 | 49–59 |
| Hard | 20–26 | 39–49 |
| Cast steel: | | |
| Soft | 39–49 | 59–65 |
| Medium hard | 33–39 | 49–59 |
| Hard | 20–26 | 39–49 |
| Hard cast steel: | | |
| Soft | 59–65 | 79–85 |
| Medium hard | 49–59 | 65–79 |
| Hard | 39–49 | 59–65 |
| Machinery steel: | | |
| 58,000 pounds per square inch | 53–65 | 98–105 |
| 72,500 pounds per square inch | 46–59 | 82–98 |
| 87,000 pounds per square inch | 39–59 | 65–82 |
| 101,50 pounds per square inch | 33–39 | 53–65 |
| 116,000 pounds per square inch | 26–33 | 46–53 |
| Tool steel: | | |
| Soft | 26–33 | 46–59 |
| Medium hard | 20–26 | 33–50 |
| Hard | 13–20 | 26–33 |
| Bronze: | | |
| Soft | 92–98 | 131–148 |
| Medium hard | 82–92 | 125–131 |
| Hard | 72–82 | 98–125 |

TABLE II. CUTTING SPEEDS FOR VARIOUS METALS.

## Experiments with Milling Cutters

The experiments were undertaken upon a horizontal high-duty milling machine in which was a block of medium-hard cast iron 130 millimeters wide (5.07 inches). There was used a cutter of high-speed steel, 90 millimeters (3.51 inches) in diameter with 18 teeth to break the chips. These helical teeth had an angle of inclination of 12 degrees, a cutting angle of 5 degrees and were so formed as to break the chips. The feed in every experiment was 508 millimeters (19.81 inches) per minute, depth of cut 4 millimeters (0.156 inches); the chips removed per minute, therefore, amounting to 264.15 cubic centimeters (16.1 cubic inches). The operation was thus a roughing one, such as is only possible on modern machines of extraordinary performance. The results of the experiment are set forth in table I.

This experiment showed that, with a constant feed and depth of cut and variable cutting velocity, there is an important increase of the power consumed.

In order to show the smoothness of the work turned out, there was used a special appliance which would record the movements of chattering. By reason of the powerful build of the machine, however, the vibration during work was so small that the pencil of the registering arrangement made only trifling movements and a difference in the line for the different stages of the experiment is not perceptible. It is therefore unnecessary to reproduce these drawings. When the two lowest cutting speeds, 6 and 7.3, were employed, there was easily perceptible a lessening of smoothness in the piece of work. Otherwise the machined surfaces were smoother than obtained by roughing operations as a rule.

If the test described be strictly applicable only to the case before us, still it permits an inference that the often employed cutting speeds of 20 to 25 meters (65 to 82 feet) per minute for roughing cast iron are very little warranted and that they only occasion an increase of power consumed. Too low cutting speeds are, of course, to be avoided also, since they prejudice the smoothness of the work.

In conclusion, may be given a table II, of cutting speeds for machining various metals with milling cutters. The values therein set forth have been arrived at in practical working experiments and are applicable to powerful milling machines and cutters with normal teeth.

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American Machinist

# Editorial

## Experimental Work Dangerous in the Small Shop

Experimental work is one of the strong, every present shop temptations. As individual temptations must be resisted, so shop temptations must be overcome. As many individual temptations when yielded to lead to personal or family disaster, so shop temptations if allowed to have sway lead on to financial ruin. Again, as certain things are dangerous for certain persons and not for others, so there are certain practices that may not injuriously affect one type of shop yet may be detrimental in the extreme to another.

To apply our title; experimental work, a universal shop temptation, is dangerous for the small shop.

Everyone mechanically inclined likes to investigate, to try something new, to experiment. Some shops have a regularly organized experimental department, and work in that department is considered on a higher plane than even the much sought for tool making. Right here is the advantage of the large, well organized shop. Its inventing and developing work is usually concentrated into one department, kept within bounds and entirely separated from regular manufacturing. Thus, it does not tend to run wild.

The small shop, on the other hand, cannot afford to have a special department and must intrust it to some few unusually skilful men located here and there throughout the manufacturing departments. With the work so distributed it is very easy for suggestions to be made here and there in regard to this or that device that seems promising, and soon others are allowed to take up experimental work. Unchecked and carried to an extreme this experiment germ may so permeate the organization as to seriously interfere with normal production. If there is one thing that should be rigorously controlled in the small shop it is this experimenting; for in that direction there is much outlay with no return whatever perhaps nine times out of ten. Of course, a certain amount of development work must be done in order to keep a firm abreast of the times, and in an agressive attitude to meet devices brought out by competitors. But the authorization for such expenditures must be given by someone competent to say whether the probable returns will meet the inevitable cost.

If possible it is best to separate experimental work entirely from regular manufacturing; the pace is much slower, there is a tendency on the part of onlookers to fritter away their time asking questions or offering advice, and the type of supervision required is different. As shop systems may run into red tape and not return a new dollar for an old one, so experimental work is most uncertain, and particularly so if it is allowed to run its own course. The small shop that has a good business but not much reserve to call upon in emergency should be very sparing of the experimental work that it does for itself and pays for itself.

## Definition of "Machine Tool"

In paragraph 197 of the Payne Tariff Act, is used the expression "machine tools." This requires that the expression should be defined. Accompanying a letter recently received from the office of the Secretary of the Treasury, is a copy of a letter addressed to the Surveyor of Customs, Grand Rapids, Mich., written by the assistant secretary and relating to this question. The text of the letter is: "The department duly received your letter on the 23d of December, in which, transmitting a catalog and packing sheet, you request information relative to the classification of machine tools and 'equipments' for wood-working machines covered thereby.

"You state that the 'equipments' can be used for many and various purposes; that they are therefore so many different machines, and that the importer enters and insists that they should be classified as 'machine tools' under paragraph 197 of the tariff act of August 5, 1909.

"In reply, I have to advise you that the department is in receipt of a letter from the collector of customs of New York, transmitting a communication from the appraiser at that port upon the subject, in which he reports that he defines 'machine tools' as machines driven by steam, or power other than hand power, for performing operations formerly accomplished by means of hand tools, and that such machines are advisorily returned for duty by him under paragraph 197 of the tariff act, at the rate of 30 per centum *ad valorem*.

"He further reports that spare parts of machine tools and extra attachments are returned for duty as manufactures of metal at the rate of 45 per centum *ad valorem* under paragraph 199 of the said act.

"The collector of customs states that his classification is in harmony with the appraiser's advisory return, and that department is of the opinion that the practice at the port of New York in this regard is in accordance with the law.

Signed, F. J. CURTIS,
Assistant Secretary."

This interpretation is intended to be in keeping with the idea of the legislators who wrote and passed the tariff act, and whether it is or is not in keeping with this original intent we do not attempt now to surmise. But from the viewpoint of the machine shop, the term has a somewhat different meaning and requires a different definition.

The term "machine tool" as defined in the letter above, includes machines used in working all materials of construction and excludes all hand- and foot-power machines. These two points, we believe, are disputable. According to common usage, the idea of metal working is fundamental in the idea of a machine tool; a definition in Webster's dictionary has the phrase "for shaping metal." Again, many hand- and foot-power machines are unquestionably machine tools—as arbor presses, kick presses, bench planers, bench shapers and the like.

The accepted idea of what a machine tool is, is perhaps given by this expression "a metal-working machine." As a definition, however, that expression is inadequate, for it leaves the word "machine" in a haze.

We understand that the National Association of Machine Tool Builders at their forthcoming convention are to take some action in regard to this matter, and we await with interest the result of their deliberations. Unquestionably, the meaning of the term can be best defined by those who are making the things that the term covers.

## National Supply, and Machinery Dealers Convention

The fifth annual convention of the National Supply and Machinery Dealers' Association and the fifth annual convention of the American Supply and Machinery Manufacturers' Association were held jointly at the Hotel Denis, Atlantic City, May 11, 12 and 13. Papers were presented by W. H. Taylor, W. H. Taylor & Co., Allentown, Penn.; Edgar E. Strong, Strong, Carlisle & Hammond Company, Cleveland; W. B. Yost, Lockwood, Leutkemeyer-Henry Co., Cleveland.

## OBITUARY

The engineering profession will be grieved to learn of the death of Walter C. Kerr, at Rochester, Minn., on May 8. Up to within two months ago, at which time he started West for treatment, Mr.

WALTER C. KERR

Kerr was actively engaged in carrying on the business of the engineering firm with which he was connected.

Mr. Kerr was born at St. Peter, Minn., on November 8, 1858, and at the age of 17 entered Cornell University, taking the mechanical engineering course and graduating with the class of '79.

He was an instructor for one year and later became an assistant professor, which position he held for two years. He then went with the Westinghouse Machine Company as a salesman and soon became manager of their Eastern sales office. In 1884 he helped to organize the firm of Westinghouse, Church, Kerr & Co.; first becoming treasurer, later vice-president and finally president, in which capacity he served until his death. In the early years of the firm he engaged personally in engineering details, but the increase in magnitude of the work undertaken soon rendered this impossible and he turned his attention to the larger questions of organization. At the same time, however, he always kept in close touch with all the engineering work through constant consultation with the engineers in direct charge.

Mr. Kerr possessed exceptional ability for organization and had the power to bring together groups of strong men and inspire them with his progressive spirit, so that they might work together strenuously and effectively toward some desired end.

In spite of his active engineering interests, Mr. Kerr found time to engage in many outside enterprises. He took more than a sporting interest in yachting and was a prominent member of the New York Yacht Club. He was also a trustee of Cornell University and held membership in the American Society of Mechanical Engineers, the American Institute of Electrical Engineers, the Canadian Society of Civil Engineers and the Franklin Institute, besides a number of social and athletic organizations. Mr. Kerr leaves a widow and four children.

## PERSONALS

*Items For This Column Are Solicited*

A. O. Smith, president of the A. O. Smith Company, Milwaukee, Wis., has been elected vice-president of the Grant & Wood Manufacturing Company, Chelsea, Mich.

Doctor Langen and Director Wolsensderger, of the Cologne works of Otto Gas Engine Company, returned to Europe, May 5, after a six weeks' visit in this country.

C. S. Newcomb, Jr., formerly connected with the Deane Steam Pump Company, Holyoke, Mass., is now acting as sales engineer with the Denver Rock Drill and Machinery Company, Denver, Colo.

D. M. Forker, assistant sales manager of the Republic Iron and Steel Company, of Pittsburg, has resigned that position and is now vice-president of the D. T. Williams Valve Company, Cincinnati, Ohio.

John Richards, of San Francisco, Cal., mechanical engineer and authority on pumping machinery, and occasional contributor to our columns, is about to start on a trip through the Southwest, after which he will sail from New Orleans for London.

E. B. Boye, formerly sales manager of the Warner & Swasey Company, Cleveland, Ohio, has been elected president of the newly organized Grant & Wood Manufacturing Company, Chelsea, Mich., which is to manufacture the multiple automatic screw machine designed by John J. Grant.

E. E. Wood, until recently president and manager of the Walcott & Wood Machine Tool Company, Jackson, Mich., will be factory manager of the new Grant & Wood Manufacturing Company. Mr. Wood is well known as an old-time machine-tool man, having been general superintendent of the Jones & Lamson Machine Company some years ago, subsequent to which he held an important position with the Niles-Bement-Pond and Pratt & Whitney companies.

# New Tools and Machine Shop Appliances

**Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost**

*ANY new or improved machine or shop appliance of interest to our readers will be illustrated and described in this department.*

*A full and more detailed description will be given—when of special interest and it appears here before being sent elsewhere.*

*ALL descriptions appear in all four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.*

## Heavy Plain Radial Drilling Machine

This is a very substantial, plain or semi-radial drilling machine, recently built by the American Tool Works Company, Cincinnati, Ohio. This has a capacity of 48 inches under the spindle, which is designed to drive a 6-inch pipe tap. This gives a good idea of its power. With the two speed, 5-horsepower motor shown, it has a speed range of 10 changes, from 11.5 to 171 revolutions per minute. Three feeds are provided by the cones alone, these ranging from 0.008 to 0.020 inch per revolution, showing that it is to be used on large work only.

As regularly built this machine has a feed box with four changes to suit the work and has the cone-pulley drive with friction-clutch driving pulleys for tapping as shown in Fig. 2. The bevel gears at the top of column transmit power with the arm in any position.

These are made with arms of 4, 5 and 6 feet carrying the same drilling head. The spindle has a vertical travel of 18 inches and carries a No. 5 Morse taper. It is counterweighted by the round weight behind, has conveniently arranged feed lever, and is regularly supplied with a friction clutch for hand feed and quick return.

## A Rust Proofing Process

The prevention of rust on iron and steel is one of the things that interest all makers and users of these materials, and for years has been the subject of much study and experiment.

The Bradley patent process for rust prevention has recently been purchased by the Bradley Rust-Proofing Company, 35-37 Ferris street, Brooklyn, N. Y.

It is a heat treatment using hydrogen gas, which has long been recognized by metallurgists as a medium for removing sulphur and phosphorus from iron and steel. The hydrogen gas is brought into contact with copper and carries with it mechanically a certain amount of the metal, penetrating the iron or steel, while it is hot, to a slight depth, changing the surface and making it impervious to the action of the oxygen in the air and water. One of the great advantages of this treatment is that it does not add to the metal, as galvanizing, tinning or plating does, and thus makes it possible to treat bolts, nuts, etc., without interfering with the thread, giving the very part that needs protection most, the rust-resisting qualities. Being a part of the metal there is no opportunity of moisture gathering underneath it, as in plating. On account of the heat it cannot be used on high-carbon, tempered or hardened steel.

It imparts a dark blue-black color to the article. Soap, water and a brush, now and then, are all that are required to keep the pieces clean.

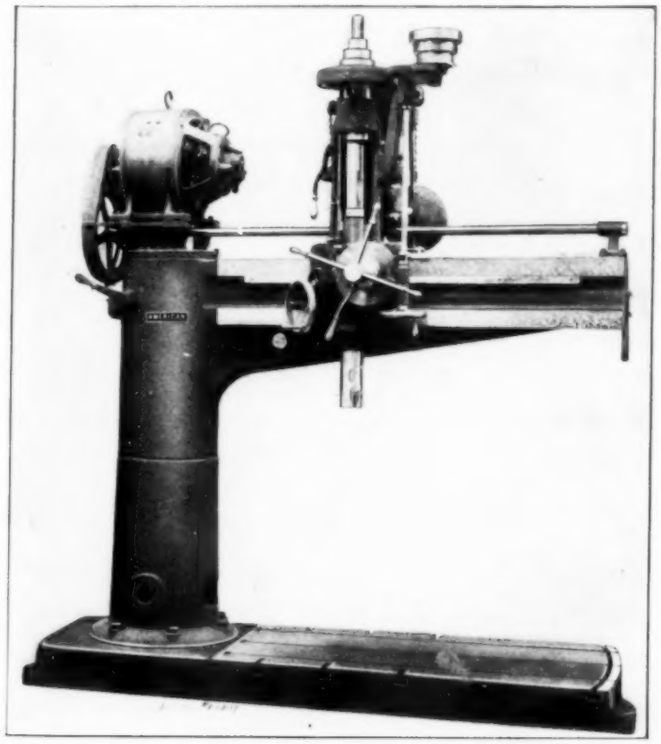


FIG. 1. SEMI-RADIAL DRILL FOR SPECIAL WORK

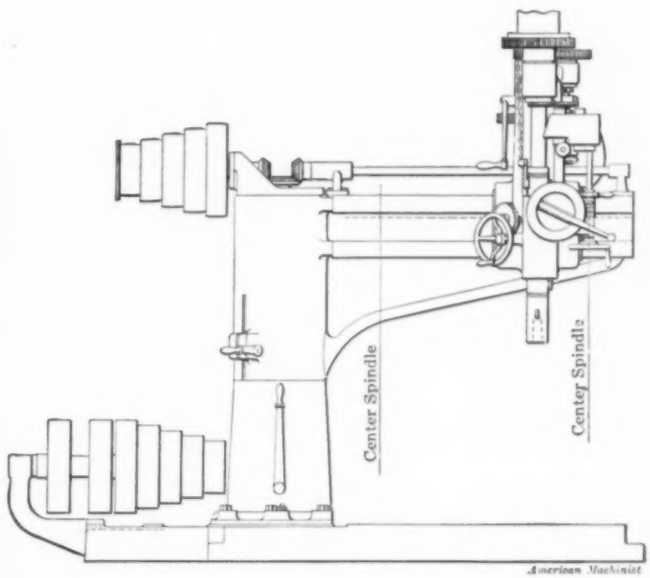
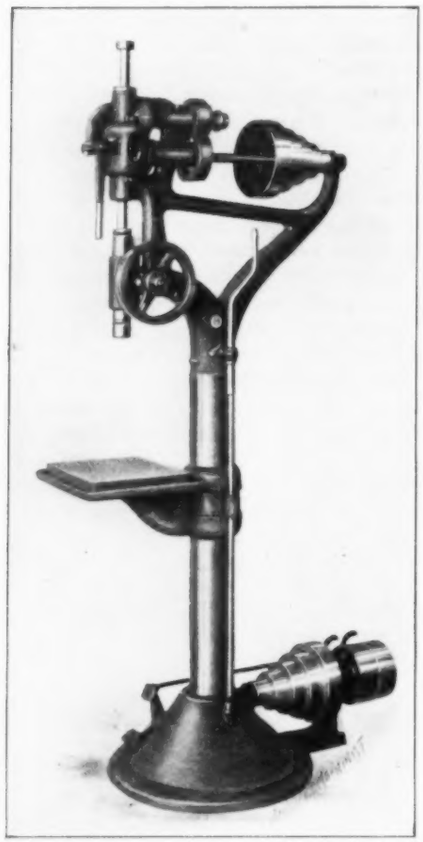



FIG. 2. AS BUILT WITH CONE-PULLEY DRIVE

## A Convenient and Rapid Tapping Drill

This has been designed to allow rapid tapping to be done, by making the control of the reverse as convenient as possible. The reversing lever is brought down so that the hand operating the hand wheel can reverse the spindle by simply touching it with the thumb.

The rim of the hand wheel is drilled to receive a rod or lever when it is desirable to have a greater leverage than the wheel affords.



A Convenient Drill for Rapid Tapping

The reversal is secured by a clutch controlled by the short arm of the lever and has a 2 to 1 ratio with the forward drive. By pulling out a slip gear at the back of the upper or reversing shaft, the reverse becomes inoperative and the tapping lever can be used to start and stop the drill. This is more convenient in some cases than to shift the belt in order to use the tapper.

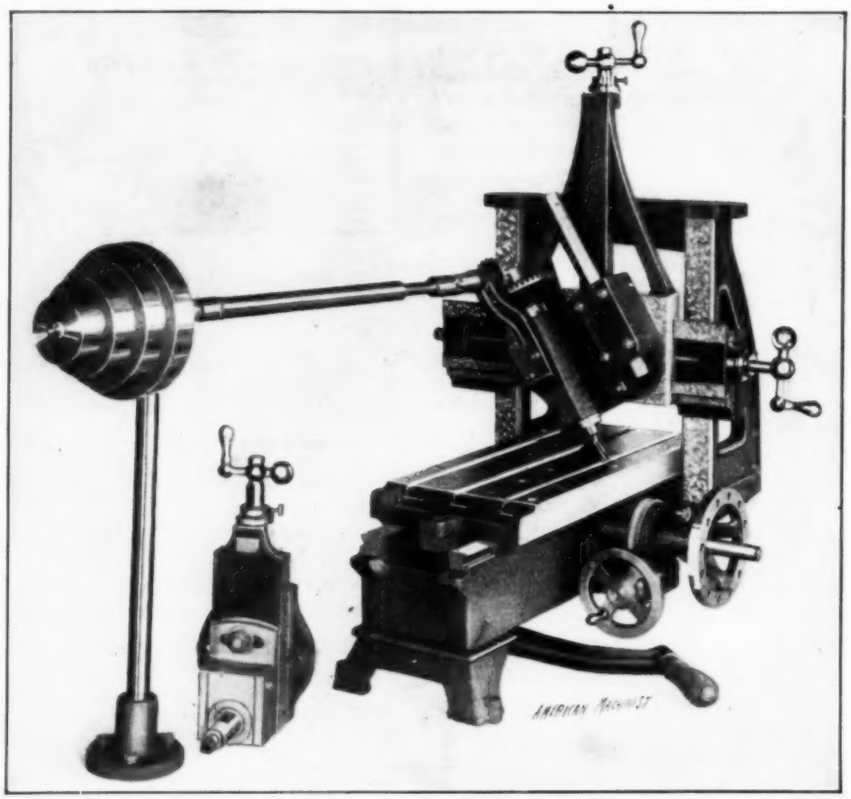
This is a 15-inch machine, has a 1 1/16 inch spindle which has a 7-inch travel and carries a No. 2 Morse taper. The table is 10x12 inches and can be set 31 inches from end of spindle. It is made by the W. F. & John Barnes Company, Rockford, Ill.

## A Milling Attachment for a Hand Planer

The halftone shows a milling attachment applied to a hand-operated planer built by the Schneider & Goosman Machine Company, 20 East Ninth street, Cincinnati, Ohio. The attachment is, of course, power driven and can be swiveled to cut at any angle. The drive is through two pairs of universal joints and bevel gears with a ratio of 1 to 2.

The spindle has a taper bearing and is provided with compensating collars to take up wear. There is also a No. 7 B. & S. taper hole in the spindle and a draw-in rod for tightening the cutter arbor.

An over-arm is provided for heavy milling. The table has worm, as well as lever feed; also quick return. The longitudinal, vertical and transverse feeds are indicated through dials reading to thousandths. The planer itself was previously illustrated and described in the American Machinist, Vol. 32, Part 2, page 1064.

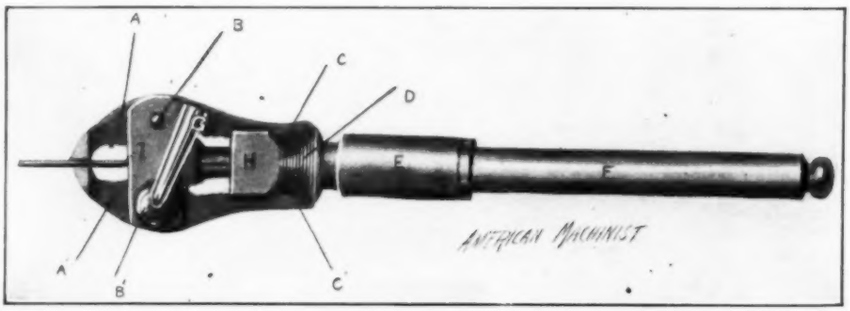


A Milling Attachment for a Hand Planer

## A Toolmakers' Pin Vise

The halftone shows an exceedingly handy little pin vise which has been put on the market by A. S. Koch & Sons, 143 Nevin street, Lancaster, Penn.

It is a "single hand" tool; that is to say, it is readily opened or closed using one hand only to manipulate the vise while the other hand holds the work in place in the jaws. The jaws *A A'*, are pivoted at *B B'*. The tails of the jaws are serrated at *C C'*, to engage with the serrations on the tapered part *D* of the sleeve *E*, which slides on the hollow handle *F*. The part




A Toolmakers' Pin Vise

*H*, of the sleeve *E* is slotted at the sides a sliding fit for the tails of the jaws *A A'*.

The lever *G* is journaled in the pivot plate *I* which is secured to the handle *F* and has a bearing for the pivots on both sides of the jaw. Formed on the stem of the lever *G* is an eccentric which operates the jaw *B'*, closing or opening it as the lever *G* is moved clock-wise or counter clock-wise. The operation of the vise is as follows: The vise is held so that the extreme end of the handle *F* is in the palm of the hand. The lever *G* is then moved by the thumb (of the same hand) until it is about in line with the opening between the jaws, this takes the strain off the work and consequently off the serrated wedge *D*. The sleeve *E* is then grasped between the thumb and forefinger (of the same hand) and drawn toward the palm of the hand. A spring opens the jaws, the work is inserted between them and the sliding block is released. The serrated wedge pushes the tails of the jaws apart and clamps the work lightly between the jaws. The lever *G* is then pushed by the thumb (of the same hand) to the position shown in the halftone and the eccentric on its stem closes the jaw *B'* firmly on the work.

## An Air Compressor

Fig. 1 shows one of a line of air compresors which is being put on the market by George S. Comstock, Mechanicsburg, Penn. They are at present being built in 8 sizes with capacities from 6½ to 140 cubic feet free air per minute and requiring from 2½ to 28 horsepower to drive them. They are built with one, two and four cylinders.

The drive is by means of a crank and modified Scotch yoke. This modification

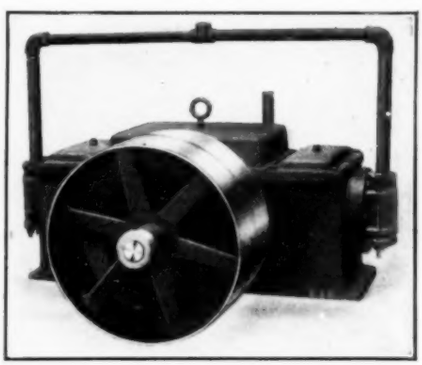


FIG. 1. COMSTOCK AIR COMPRESSOR

of the Scotch yoke acts as a universal joint and insures equal distribution of the pressure. With it the parts may wear out of alinement without seriously affecting the operation of the machine. Fig. 2 shows the yoke construction.

The main frame of the compressor is a single casting provided with large water jackets for the cylinders and valves. The cover of the main frame may readily be lifted off for the inspection of the working parts. It is not bolted down.

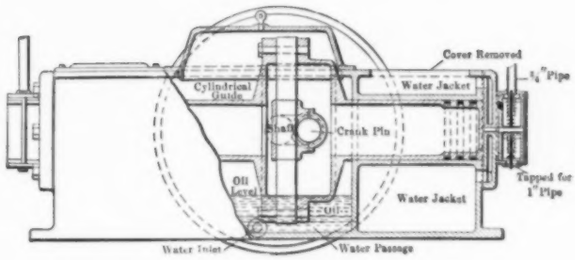



FIG. 2. CRANK MECHANISM

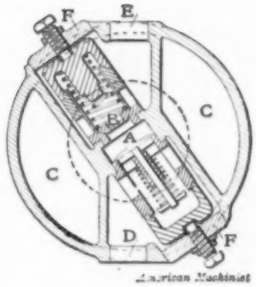


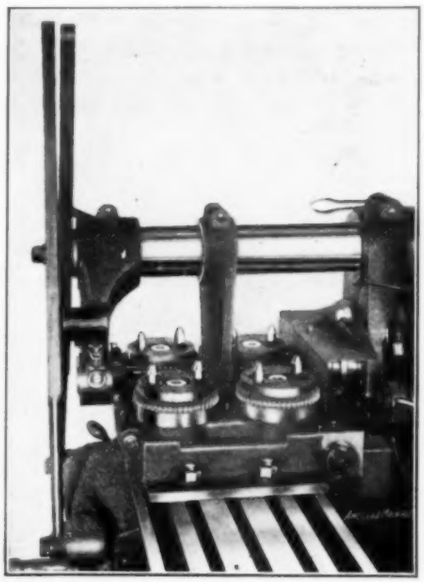

FIG. 3. CROSS-SECTION OF END SHOWING VALVE

Fig. 3 shows the valve arrangement. *D* is the inlet, *E* the delivery. *A* is the inlet valve, and *B* the delivery valve. *C C* is the water space for cooling.

The crank works in an oil bath and the lubricating oil is splashed on the pistons and yoke.

## A Worm Gear Hobbing Attachment

The worm-gear hobbing fixture shown herewith is made by the Garvin Machine

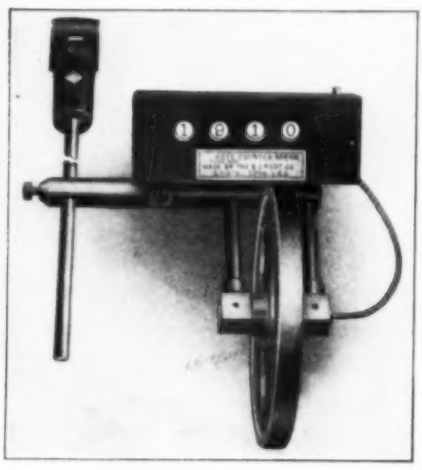


A WORM-HOBBING ATTACHMENT

Company, of New York City, and is shown applied to one of their No. 13½ plain milling machines. The fixture will cut two worm gears at a time. While this is being done, the finished gears can be taken off by loosening the nuts, new gear blanks put on and made ready for cutting. By using a slow feed to the table, the blanks are fed up against the hobs and when the proper depth of the tooth is reached, the slide is automatically tripped. The operator then runs it back until the cut is started on the other two blanks. The feed is then reversed and thrown in so that the slide will feed in the opposite direction. When the worm gears are being cut they are continually rotating, being driven from the spindle of the machine by worm gearing through a positive clutch. This clutch is thrown in mesh with either pair of worm gears by moving the slide in the direction, according to which of the worm gears are to be cut. The pair of hobs is driven from the spindle by an ordinary collet chuck and is run in the socket bearing in the arm yoke. The hobs are made in two pieces, the junction being made in the central bearing and one dogs the other around.

## A Lineal Measuring Machine

A device originally designed for measuring paper cardboard or textile goods as they are manufactured, but which is adaptable to the measurement of wire, rope, belting, chain, flat steel, etc., is man-



ROOT LINEAL MEASURING MACHINE

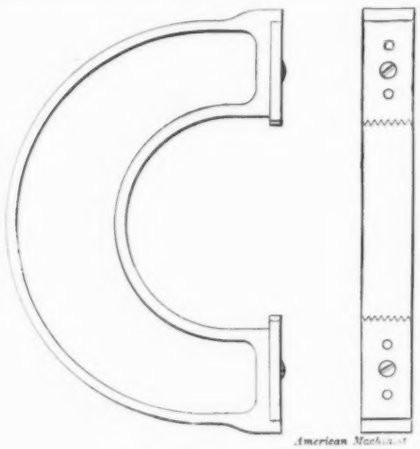
ufactured by the C. J. Root Company, Bristol, Conn. As seen in the illustration, a measuring wheel swinging on a bracket, rests upon the material being manufactured and to be measured, while a flexible shaft extending from the wheel to the counting box registers the length

passing beneath it. Wheels may be furnished for measuring in units of 12 inches, 20 inches, or 36 inches. It is also easy to reset the dial to zero when desired. With the flexible shaft construction it is possible to attach the counter at any convenient point on the machine, or the building, or even separate from both.

## A Thread Snap Gage

The line cut shows a snap gage designed for the rapid inspection of threaded work. It is especially applicable to work of large diameter and fine pitches so common in automobile work.

It consists of two properly formed, hardened and lapped jaws fastened to a



A Thread Snap Gage

C-frame. The gage is readily applied to the thread at any point without screwing on and shows any inaccuracy in pitch, top or bottom diameters and angle of the thread. The gaging points are readily kept clean. These gages are made by K. L. Herrmann, Detroit, Mich.

## The Sager Drill Socket

In the accompanying halftones there is illustrated a new tool in the shape of a drill socket designed to overcome the broken drill-tang trouble. The socket itself fits into the drill spindle and a split, taper-sleeve screws into the lower end of the socket. The inside of this sleeve has standard taper for taper-shank drills.

It is claimed that when the drill is inserted and screwed up lightly by hand, the operation of drilling causes the taper sleeve to be screwed tighter into the socket and thus grip the drill the more positively, the greater the twist required.

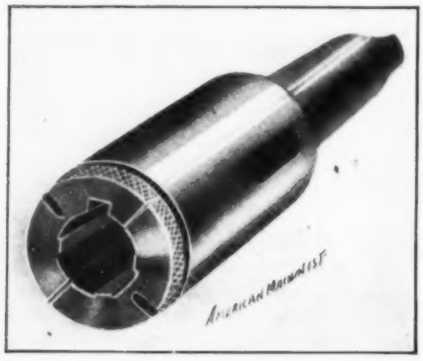


Fig. 1. Sager Drill Socket

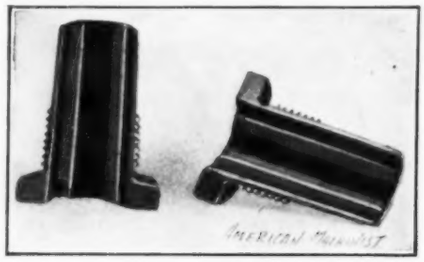


Fig. 2. Internal Construction

Suitable grooves in the sleeve put the grip onto ridges so as to eliminate slipping from grease and dirt.

There is no set screw required, nor any wrench or separate collar, nor yet is there any keyway or flat to be cut in the drill shank. Moreover, it does not matter whether or not the tang has been broken or bent, as the gripping is done on the body of the taper drill shank.

The removal of the drill is accomplished in the usual way by driving a drift through a suitable opening.

This socket is made so that any one size of socket will cover a considerable range of drill shanks, thus economizing in the number of sockets necessary to be carried. They are made in sizes to suit drills from ¼ inch to 3 inches. There are also made, special short sockets for the small sizes, so as to economize space between the drill spindle and the table; furthermore, special sockets are made for pneumatic motors, and if desired, sockets may be bought with unfinished shanks, so that the purchaser may finish these to suit special conditions.

Special sleeves are also made for these sockets, to take care of high-speed steel drills with twisted shanks and these can be accommodated as well as the ordinary carbon drill.

This device is manufactured by the Sager Drill Socket Company, West Albany, N. Y.

## Crucible Furnace and Oil Burner

The American Combustion Company, of New York has recently placed upon the market a furnace for melting metals in a crucible on which they have applied for a patent. They have also designed a special burner for using crude oil for the fuel.

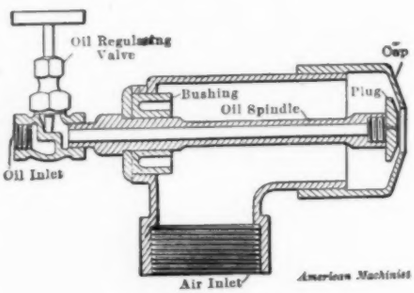



Fig. 2. The Burner

In Fig. 1 are shown sectional views of the furnace. *A*, *B*, *C*, *D*, *E* and *F* show how the firebrick lining is placed in the furnace, and *H* shows the firebrick stand for the crucible. The inside wall of the shell is surrounded with a ¼-inch asbestos lining before the firebricks are put into place.

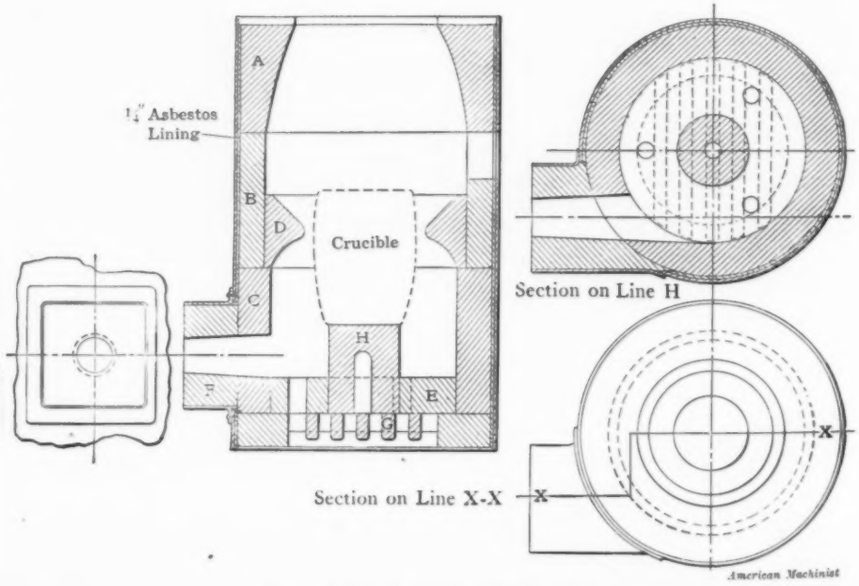



Fig. 1. Crucible Melting Furnace

In Fig. 2 is shown the burner that is used for the crude oil. The flow of the oil to the oil spindle is regulated by the oil valve and it passes through a very small hole in the plug, this hole being made with a No. 65 or 70 drill. The oil is then caught up and sprayed by the current of air that passes through the opening between the plug and the cap. This current of air completely surrounds the cap plug, through which the oil comes, thus causing it to enter the furnace in a finely divided spray.

It is claimed that but from 2½ to 3 pounds pressure of air is required to give a practically perfect combustion, and heat the furnace up to a temperature that will melt nickel, or about 2650 degrees Fahrenheit. This burner is also being applied to other kinds of furnaces, as well as in other places where it can be used.

## Cone Speed Variator for Planers

The principle involved is that of a pair of opposed four-step cones operated by an endless belt betwen them, with ready means for slacking and shifting the belt from step to step, after which the necessary tension is applied to operate the planer under the usual conditions. The belt is shifted by a pair of forks or belt loops, which are actuated alternately along guide rods by means of a pair of cylindrical cams which revolve alternately, through the medium of a set of intermittent gears, operated by a convenient handwheel. The cam rolls have hight, which operates a pair of bell cranks through a link. The bell cranks serve as levers to slide the driven cone toward the driver, thus slacking the belt. After the belt is located on the desired cone step, the tension desired is again placed upon it by moving the hand lever and clamping by a binder handle.

All the parts of the variator are massive and rigid, the shafts being of large diameter and run in dynamo bearings which are bronze lined. They are supplied with liberal oil wells and ample return ducts to prevent the oil from escaping or coming in contact with the belts. Four rates of cutting speeds are provided, 20, 30, 40 and 50 feet, or any similar proportion desired. The return is maintained constant at all cutting speeds at about 80 feet per minute. In Fig. 1 is shown the variator as applied to a planer.

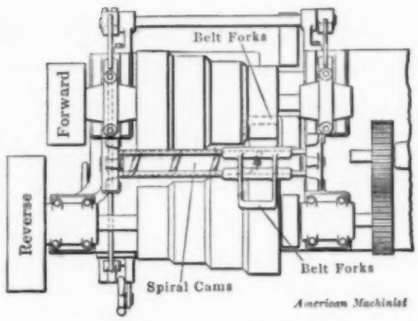



FIG. 2. CONES AND BELT SHIFTER

spiral slots and each belt fork is moved along the guide rods by a roller operating in these spiral slots. The relation of the cams and forks shifts the belt off the high step of one cone before placing it on the high step of the other. This, together with the slacking of belt permits shifting a wide belt with ease and certainty. The rises on the cones are beveled so as to offer no resistance to the passage of the belt.

The slacking of the belt before shifting is accomplished by means of a long hand lever, at a convenient operating

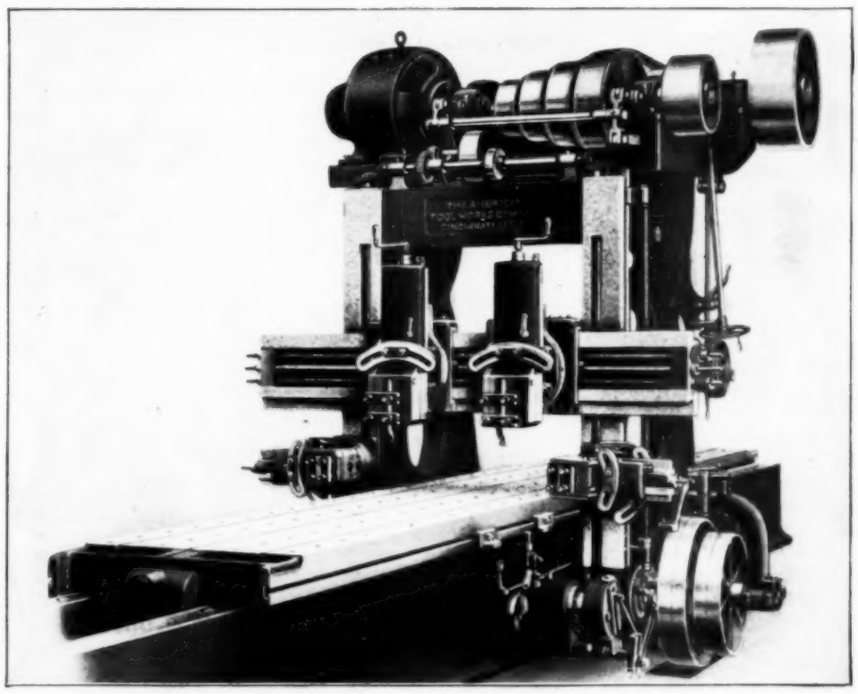


FIG. 1. CONE VARIATOR APPLIED TO AN AMERICAN TOOL WORKS PLANER

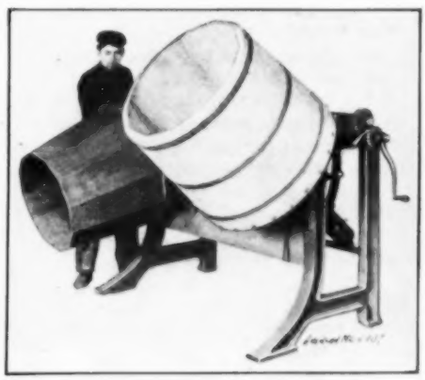
Fig. 2 shows the connections for motor drive, but when the belt drive is supplied, the drive pulley is attached to cone shaft at the same point at which the gear is located. The drive can be obtained from a countershaft or from the line shaft, this being dependent upon the speed of the line shaft. Slow shafts of 150 revolutions or thereabouts require an intermediate shaft.

It will be noted that by shifting the driven or forward cone, the driving-belt tension is not materially altered, owing to its being almost directly over the driving shaft. This is a very simple arrangement and thus avoids what might otherwise be a bothersome feature in shifting from one cone to another. This variator is made and applied to planers of their make by the American Tool Works Company, Cincinnati, Ohio.

## A Double Tilting Tumbler

This machine takes up less room than two single machines and is driven by one belt.

The barrels are entirely independent and one can be emptied and refilled while the other is in motion. The barrels are also interchangeable and can be of wood or metal.



INTERCHANGEABLE DOUBLE TILTING TUMBLER

The double possesses all the advantages of the single machine, and work and water can be put in the barrel, articles inspected to note progress, and barrels tilted to the angle desired, all without stopping the machine.

These machines are made by the Baird Machine Company, Oakville, Conn.

# Different Views on Sand Blasting Castings

*By J. Watt*

It's amusing the different viewpoints of different people. Some years ago I bought castings from a concern who had the reputation for turning out nice clean castings. They charged two or three cents a pound more than anyone else in town, but on small thin work they were so far superior to the others that they had no trouble in getting the extra price. The castings, which were too fragile to tumble, were always pickled and everyone was satisfied till one of the other founders put in a sand-blast plant. In conversation with the boss of the foundry one day, I said: "Why don't *you* put in a sand-blast outfit?"

To which he replied: "Not on your life, our castings *are* bad enough but *look* good enough now. Why should we put in one of those things to show up all the imperfections?"

Cast iron is, at its cleanest, dirty enough to machine, and a well sand-blasted casting ought to bring joy to the heart of the machine hand, but some machine hands seem hard to please. An AMERICAN MACHINIST man was in the Bullard plant in Bridgeport, Conn., recently. On one of the planers were a lot of nicely sand-blasted castings. Turning to the planer hand, he said: "How do you like those nice clean sand-blasted castings?" To which he received the laconic reply: "I can't see as it hurts 'em any."

Apart from the cleanliness there is a great saving in wear on the tools, for although pickling loosens the sand, it does not remove it, as blasting does.

According to *Foundry*, a census of the foundry industry in the United States and Canada showed on April 1, 1910, a total of 6594 foundries. A notable increase is in malleable and steel foundries, there now being 443 plants producing malleable and steel castings.

# Increasing Shop Capacities

## Where More Tools Will be Needed

Joe Dunlap, Luling, Tex., will erect an ice-making plant.

H. P. Hellmer, Platteville, Wis., will build a wagon shop.

The electric-light plant, at Homer, La., was destroyed by fire.

Moses Hoff, Ellsberry, N. D., is erecting a blacksmith shop.

A waterworks system will be installed at Breaux Bridge, La.

The Hamilton (Ont.) Cotton Company is building an addition.

R. L. Michaelis is erecting a blacksmith shop at Hecla, S. D.

Chas. J. Duer, New Richmond, Wis., will erect a machine shop.

Math Pitzl's brewery at Munich, Minn., was destroyed by fire.

The National Oil Company, Lansing, Mich., is to enlarge its plant.

The C. W. Cheney Company, Eau Claire, Wis., will erect a flour mill.

The Russell Falls Paper Company is building a mill at Russell, Mass.

The foundry of Hillis & Sons, Halifax, N. S., was destroyed by fire.

F. R. Marrs is planning an addition to his planing mill at Wolford, N. D.

The Penn Chain Works, Reading, Penn., will build a one-story addition.

The Beta Fertilizer Company, Eatontown, N. J., is to enlarge its plant.

The Canada Preserving Company, Hamilton, Ont., is extending its plant.

The Columbus (Wis.) Canning Company will erect four new buildings.

The Delevan (Wis.) Shoe Company is planning a two-story addition.

Hans Meyer, Manitowoc, Wis., expects to erect a factory for cabinet work.

The Updike Milling Company, Sioux City, Iowa, will erect a $5000 elevator.

The Anniston (Ala.) Electric and Gas Company is to enlarge its power house.

The Ohio Pattern Works Company, Cincinnati, Ohio, will build an addition.

*Authentic news is solicited for this department. Real opportunities for the sale of machinery of any kind.*

The J. T. McMillan Company, of St. Paul, Minn., will erect a rendering plant.

The Chipman Holton Knitting Company, Hamilton, Ont., is building additions.

The Fond du Lac (Wis.) Cold Storage Company will erect a three-story addition.

E. J. Balga & Co., Seymour, Wis., will establish a pickle factory at Shawno.

Major Albert Roberts, of Devils Lake, N. D., will erect a blacksmith shop.

The mills of the Eau Claire (Wis.) Linen Company were burned. Loss, $50,000.

The Star Wall Paper Company, Joliet, Ill., is building a large addition to its plant.

The city light and power plant, at Brainerd, Minn., was burned. Loss, $40,000.

The Marshfield (Wis.) Brewery expect to install electric power in the near future.

The Grand Trunk Railway is doubling size of roundhouse at Hamilton, Ontario.

The bottling works of the Genesee Fruit Company, Bouckville, N. Y., was burned.

A $10,000 factory is to be erected by the Racine (Wis.) Iron and Wire Company.

The Monument Pottery Company, Trenton, N. J., is erecting a new four-story factory.

The Pelley Toilet Paper Company, Fulton, N. Y., will erect a plant at Springfield, Mass.

Fire destroyed the plant of the American Cement Company, Acme, Tex. Loss, $38,000.

The Union Towel Supply Company, Jersey City, N. J., will erect a new factory building.

Florey Bros., Washington, N. J., have commenced the erection of a new piano factory.

The Ontario Dyeing Company, Philadelphia, Penn., will erect a new $50,000 factory.

The Lake Superior Knitting Company, Appleton, Wis., will erect a three-story addition.

The Rogers-Brown Iron Company, Buffalo, N. Y., has let contract for additions to its plant.

Gerald Cooper, manufacturer of mercerized yarns, will erect a new mill in Providence.

J. I. Foltz, Dearborn, Neb., is said to be trying to secure site for a new canning factory.

The city council, Okotoks, Alberta, is having plans prepared for a new electric-lighting system.

The Fulton Bag and Cotton Mills, Atlanta, Ga., has had plans prepared for a five-story addition.

Hirsh & Grimsburg, Medway, Mass., strawgoods manufacturers, will build a three-story addition.

Woonsocket (R. I.) Machine and Press Company will build an addition to its foundry.

Fire destroyed the plant of the Excelsior Pottery Company, Newark, N. J. Loss, about $10,000.

The National Comb Company, Leominster, Mass., is looking for site on which to erect a plant.

The Chicago (Ill.) Drop Forge and Foundry Company is erecting an addition to its plant.

The Minneapolis (Minn.) Motor and Truck Company may locate its plant at Beaver Dam, Wis.

The R. Starkweather Company, Oshkosh, Wis., is in the market for a second-hand Corliss engine.

The O. K. Clutch Company, The Bourse, Philadelphia, Penn., is seeking suitable site for a plant.

The Sanitary Earthenware Specialty Company, Trenton, N. J., will build an addition to its plant.

The Vaughn Knitting Company, Pottstown, Penn., is to rebuild mill, recently burned, on a larger scale.

The Johnston Paper Box Manufacturing Company, Richmond, Va., is erecting a three-story addition.

Fire destroyed the plant of the National Granite Company, Montpelier, Vt. Loss, about $20,000.

The Baker Castor Oil Company, Jersey City, N. J., will erect a new six-story factory to cost $60,000.

M. C. D. Borden will erect a cotton mill at Fall River, Mass., to have a capacity of 108,000 spindles.

Hugh G. Twaddle, of Hecla, S. D., is considering the erection of an electric-light plant at Baker, Mont.

The Central Massachusetts Electric Company, Palmer, Mass., is to make some additions to plant.

The Gotzian Shoe Company, of St. Paul, Minn., will erect an addition to its plant at Eau Claire, Wis.

The mill of the J. H. Maloney Lumber Company, at Cobden, via Superior, Mont., was destroyed by fire.

The Hartley Silk Manufacturing Company, 483 Broome street, New York, is seeking site for a new plant.

The pumping station of the Philadelphia Gas Company, near Ford City, Penn., was destroyed by fire.

C. H. Sauer & Co., Turtle Lake, Wis., are looking for a site on which to erect a modern woodworking plant.

The Ames Gas Company, Ames, Iowa, capitalized at $50,000, will erect a plant. H. L. Griffin is secretary.

The Lyons Boiler Works, De Pere, Wis., is planning the erection of a new 300-horsepower power house.

The Western Glazed Sewer Pipe Company, Boise, Idaho, is endeavoring to secure site for a new factory.

The plant of the Linderman Box and Veneer Company, Eau Claire, Wis., was destroyed by fire. Loss, $40,000.

The Gray Iron Foundry, Reading, Penn., will erect a new three-story manufacturing building and addition.

The Buffalo (N. Y.) Foundry Company has secured permit for the erection of machine shop to cost $60,000.

An addition is to be built to the jewelry-making plant of the G. K. Webster Company, North Attleboro, Mass.

The Appleton (Wis.) Chair Company will move to Appleton Junction, where a new plant will be erected.

The Baird-North Company, Providence, R. I., jewelry manufacturers, will make extensive improvements.

The Gundlach Machinery Company, Belleville, Ill., is in the market for one 32-inch lathe, planer, drill press.

The Hartford (Conn.) Electric Light Company will erect a new boiler house and an addition to engine house.

The plant of the Hines Lumber Company, Corinth, Miss., was destroyed by fire. Loss, $25,000. Will be rebuilt.

It is stated the Stockton (Cal.) Iron Works is planning the establishment of a branch plant in the East.

E. T. Wright & Company, Hamilton Ont., manufacturing tin and agateware, are building an addition to their plant.

The plant of the Charles Cranford Asphalt Company, Brooklyn, N. Y., was destroyed by fire. Loss, about $150,000.

The Andrews Chemical Company, Davenport, Ia., will expend $50,000 on building and equipping a new plant.

The Gorham Manufacturing Company, silversmiths, will erect an addition to its plant at Elmund, Providence, R. I.

The Peoples Brewing Company, Trenton, N. J., will erect a building to be used as a machine and blacksmith shop.

The plant of the North Side Sash and Door Company, Minneapolis, Minn., was burned. Loss, about $90,000.

Fire destroyed the plant of M. L. Shoemaker & Company, Ltd., Philadelphia, Penn., making fertilizers, oils, tallow.

The New Britain (Conn.) Machine Company will erect a five-story addition to its plant and a new power house.

The Kelly Racine Rubber Company, Racine, Wis., plans the erection of a factory building, including power house.

The Sullivan Machinery Company has commenced the erection of a six-story addition to its plant at Claremont, N. H.

The Johnson Piano Company, Champaign, Ill., is said to be considering the removal of its plant to some other location.

Work has been commenced on the new $200,000 building for the Northwestern Knitting Company, Minneapolis, Minn.

A. A. Barthelmes & Co., Toronto, Ont., manufacturing piano actions, will erect a new five-story factory to cost $70,000.

A new engine, generator and boiler will be installed in the municipal electric-light and water plant at Alexandria, La.

The city of New Orleans, La., will issue $7,000,000 bonds for additions to waterworks, drainage and sewage systems.

The Equitable Pottery Company, Trenton, N. J., is erecting an addition and will increase the capacity of its power plant.

The plant of the Humbird Lumber Company, at Sand Point, Idaho, was destroyed by fire, causing a loss of about $750,000.

The Petre Carbureter Company, Cleveland, Ohio, has increased its capital to $250,000 for the purpose of enlarging its plant.

The plant of the Ramseur (N. C.) Furniture Company was almost entirely destroyed by fire, entailing a loss of over $80,000.

R. H. Deyo & Co., Binghamton, N. Y., have started the erection of a new factory for the manufacture of gas and gasolene engines.

The Barnes Drill Company, Rockford, Ill., is now erecting a new shop for the manufacture of drilling machines and lathes.

The Deckman Duty Brick Company, Collinwood, Cleveland, Ohio, is in the market for smoke consumer, steam jet and air type.

The Precise Company, New Castle, Ind., manufacturing automobile parts, etc., is said to be considering enlargement of its plant.

The Baker Manufacturing Company, Evansville, Wis., manufacturing windmills, will erect two additions, including power house.

The Farrell-Cheek Steel Foundry Company, recently organized, has awarded contract for the construction of a plant at Sandusky, O.

The E. L. LeBaron Foundry Company, whose plant at Bridgewater, Mass., was recently burned, will rebuild in Campello, Mass.

The Ideal Concrete Machinery Company, South Bend, Ind., is making investigations for the purpose of securing site for a new plant.

J. P. McDonald, 42 Broadway, New York, and associates, have secured franchise for the construction of 400 miles of railroad in Haiti.

The Boston & Maine Railroad has awarded contract for the construction of a roundhouse and repair shop at South Lawrence, Mass.

The Portland (Ore.) Railway, Light and Power Company has commenced the erection of a substation at the foot of East Lincoln street.

The Spencer (Iowa) Light and Water Works are planning the installation of new engine and boiler sometime during the summer.

Corbet Brothers Machine Works, Owen Sound, Ont., is incorporating as the Corbet Machine Company, Ltd., and will erect a new building.

A ten-story cold-storage stock house will be erected for Jacob Ruppert, at Third avenue and Ninety-first street, New York, to cost $300,000.

The stone crusher and air plant of the Widell Company, at the Klondike quarry, Mankato, Minn., was destroyed by fire. Will be rebuilt.

The soap and glycerin plant of the Peet Brothers Manufacturing Company, Kansas City, Kan., was burned, entailing a loss of $1,500,000.

The Godfrey Gas Engine Starter Company, Overland, Ohio, capitalized at $75,000, will erect a plant for the manufacture of gas-engine starters.

The Dunbar Brothers Company, Bristol, Conn., manufacturing springs, bells, etc., has awarded contract for the construction of a three-story addition.

The Sioux City (Iowa) Cement and Machinery Company will be in the market for a complete line of machine-shop tools, including lathes, drills, etc.

The Detroit (Mich.) Can Company is planning the erection of another building, which will increase the output from 50,000 to 150,000 cans daily.

It is said the Snigo Manufacturing Company, Irwin, Penn., is trying to find suitable location for a new plant for manufacturing ice-cream and milk cans.

Chickering Brothers are having plans prepared for a $125,000 piano factory to be erected at South Park avenue and Twenty-third street, Chicago, Ill.

Plans are being drawn for a new $60,000 factory for the Kansas City (Mo.) Automobile and Vehicle Company, at Twentieth street and Tracy avenue.

Plans have been prepared for five three-story factory buildings for the Edward Bennett Pottery Company, Baltimore, Md., to replace plant recently burned.

The Osage Manufacturing Company, Bessemer City, N. C., will expend, it is said, $75,000 for additional carding machinery, looms, electrical motors, etc.

The Upson Nut Company, Cleveland, Ohio, has secured a building permit and a new mill will be erected in which the company will make its own steel bars.

Work has been commenced on the new metallurgical testing plant for the Colorado School of Mines, Golden, Colo., for which $75,000 has been appropriated.

The Harley-Davidson Motor Company, Milwaukee, Wis., is having plans drawn for a new five-story factory, which will have a yearly output of 8000 motorcycles.

The plant of Beall Brothers Mining and Tool Company, at East Alton, Ill., was burned, causing a loss of about $75,000. Plans are being made for rebuilding same.

Proposals will be received at the office of constructing quartermaster, Fort Des Moines, Iowa, until 3 p.m., June 3, for installation of a steam-heating plant in hospital.

Work will be started at once on the rebuilding of the burned portion of the plant of the Pittsburgh Plate Glass Company, at Ford City, Penn. The loss was $400,000.

The American Brass Company is planning for the expenditure of from $1,000,000 to $3,000,000 in the extension of the plant of the Chicago Brass Company, at Kenosha, Wis.

The Connecticut Computing Machine Company, New Haven, Conn., has awarded con-

tract for the rebuilding of its boiler house, which was partly destroyed by fire recently.

The Bridgeport (Conn.) Malleable Iron Company will soon award contract for the erection of a new power house, in which three large boilers and three engines will be installed.

Fire destroyed the plant of the Dix Manufacturing Company, Lewistown, Penn., causing a loss of $20,000. The company manufactured harness and leather dressings, stock and poultry foods.

The Diepress Company, Cazenovia, N. Y., is in the market for about $2000 worth of second-hand machine tools, including two drill presses, two lathes, milling machine and small bench tools.

W. E. Nelson, Kasota building, Minneapolis, Minn., and F. T. Barber are interested in the Nelson Manufacturing Company, and are said to be looking for site in Canada for a large and modern paper mill.

B. W. Smith, Montpelier, Ind., has invented a new steel-rail tie fastening and is interested in the organization of a company to manufacture same. It is expected the proposed plant will employ 100 hands.

Bids will be received until 3 p.m., May 31, at the office of the constructing quartermaster, Whipple Barracks, Ariz., for the construction of an ice plant. Information can be had of Second Lieutenant G. G. Bartlett.

The Isthmian Canal Commission, Washington, D. C., will receive bids up to 2:30 p.m., June 1, for chain blocks, screw jacks, boiler clamps, cotters, cable, pliers, gage glasses, leather belting, etc., as per Circular No. 583-A.

Proposals will be received at the office of supervising architect, Treasury Department, Washington, D. C., up to 3 p.m., May 28, for furnishing metal lockers as per Schedule No. 5. James Knox Taylor, supervising architect.

Fire in the chemical laboratories of the Medico-Chirurgical Hospital, Philadelphia, Penn., caused about $25,000 damage to building and ruined about $50,000 worth of surgical instruments, apparatus, equipments and chemicals.

L. E. Ewing, 2041 East Nineteenth street, Cleveland, Ohio, is forming the Findlay Motor Company and has secured site at Findlay for a plant for the manufacture of touring cars and delivery trucks. About $50,000 will be spent on equipment.

J. Lawrence Maine, 220 Broadway, and S. J. Smith, 50 Church street, New York, are said to be interested in the establishment of a new cotton-weaving plant for which they are trying to find suitable site. The plant is to employ from 1000 to 5000 hands.

Sealed proposals will be received by constructing quartermaster, Fort Bayard, N. M., until 11 a.m., May 28, for furnishing and installing machinery for power refrigerating and electric-lighting systems. Information can be had of First Lieutenant Chas. C. Winnia.

Bids will be received by P. E. Ryan, secretary, National Transcontinental Railway Commissioners, Ottawa, Ont., until 12 o'clock noon, May 25, for equipment necessary for power house to be erected east of Winnipeg, including boilers, heaters, stokers, pumps, engines, generators, etc.

Bids will be received at the office of the constructing quartermaster, 655 Congress street, Portland, Me., until 10 a.m., June 2, for constructing and remodeling electric-lighting system at Fort McKinley, Me. Information can be had of Capt. C. F. Humphrey, constructing quartermaster.

Proposals will be received at the Frankford Arsenal, Philadelphia, Penn., up to 1 o'clock p.m., May 31, for supplies for the year ending June 30, 1911, including smokeless powder, steel and iron, sheet tin and zinc, pig lead, copper and tin, iron castings, hardware, steam fitting and electrical supplies, leather belting, etc.

The General Chemical Company of the United States, capitalized at $25,000,000, is to erect a plant near Chester, Penn., which, it is said, will cost $10,000,000. The company is now erecting plants in Pittsburg and San Francisco, and owns the Moro Phillips Works, the Standard Chemical Works, and the United States Works, all of Camden, N. J.

Bids will be received at the office of the constructing quartermaster, Room 3, Keefe Hall, Cheyenne, Wyo., up to 9.30 a.m., May 23, for the construction, plumbing, wiring for electric motors and lights, electric fixtures, furnishing and installation of laundry machinery and equipment, boiler, feed pump, etc., for laundry at Fort D. A. Russell, Wyo. Information can be had of Capt. V. K. Hart, acting quartermaster.

The Grant & Wood Manufacturing Company, capitalized at $1,000,000, has been incorporated at Chelsea, Mich., to take over the business of the Grant Automatic Machine Company, of Cleveland, which manufactured the automatic screw machine invented by John J. Grant. The plant of the Chelsea Stove and Manufacturing Company has been secured for the manufacture of the machines. Eben B. Boye, formerly of the Warner & Swasey Company, is president, and E. E. Wood, of the Walcott & Wood Machine Tool Company, will be factory manager.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: May 24—40,000 pounds deck bolts and nuts (schedule 2477), drafting-room supplies (schedule 2458), metal lockers (schedule 2467), blueprint paper (schedule 2461), bronze, cast-iron castings, ferrosilicon, ferromanganese (schedule 2456), round forged steel, double special crucible tool steel (schedule 2476), air compressors, motors, etc. (schedule 2450), ½-ton triplex trolley blocks (schedule 2476), rivet-heating furnaces (schedule 2477), 5000 lb. steam drop hammer (schedule 2449), gasolene-propelling machinery (schedule 2451), drafting machines (schedule 2458), electrically driven pump (schedule 2459), transformers, generators, etc. (schedule 2450).

## BUSINESS ITEMS

E. S. Jackman & Co., Chicago, Ill., agents for Firth-Sterling Steel Company, announce that E. O. Reynolds and Joseph Smith will travel exclusively west and south of Denver and El Paso.

Schneider & Goosmann Machine Company has been organized, succeeding the Fred Schneider Machine Tool Company, and will continue the manufacture of small metal planers at 20 East Ninth street, Cincinnati, Ohio.

The Denver Rock Drill and Machinery Company, Denver, Colo., has made arrangements whereby they will act as agents for Denver, El Paso and Salt Lake City for the International Steam Pump Company, the Brownell Company and the Foos Engine Company.

The firm of J. B. Chapman & Co., Springfield, Mass., which was dissolved some months ago, is now succeeded by the Rider-Bagg Company, which consists of a partnership of Thos. J. Rider, a partner in the Chapman Company, and F. P. Bagg. The new company has a new modern brass foundry situated at 369 Birnie avenue, Springfield, Mass.

The Bridgeport Metal Treating Company, 120 Stratford avenue, Bridgeport, Conn., has recently acquired the hardening business of A. G. Barrow Company, of that city, and completely renovated the old plant, installing new and uptodate equipment. A large addition is now being built, which will enable them, within a very short time, to more than double the present capacity of the plant.

The Garwood Electric Company, Garwood, N. J., reports having taken a number of orders during the month of April, among others a large electrical equipment for the new Whitehall building, New York City, which is said to be the largest building in the world. An installation of four 150 kilowatt, 250-volt generators for the Brewster Company, of Long Island City, was also booked.

An arrangement has been made by the Cutler-Hammer Manufacturing Company, Milwaukee, Wis., whereby they will hereafter manufacture and market for Kohler Brothers, in the United States and Canada, the various types of push-button operated controllers, comprised in the Kohler system of electric control. For the purpose of carrying this arrangement into effect all data, records, etc., pertaining to the Kohler system have been transferred to the Cutler-Hammer Manufacturing Company.

## NEW INCORPORATIONS

Harris Brick Company, Cincinnati, Ohio. Manufacture brick, etc. Capital, $50,000. Incorporators, R. H. Coney, W. W. Coney, F. Lawson Moores, etc.

Federal Wire Company, Newark, N. J. Manufacture wire goods of all kinds. Capital, $100,000. Incorporators, G. Haussling, G. B. Winship, J. W. Laffey.

Franklin Glass Company, Columbus, Ohio. Manufacture glass products. Capital, $75,000. Incorporators, H. L. Liester, H. E. Dickinson, E. T. Kell, etc.

The Galva Heater Company, Galva, Ill. Manufacture and sell boilers, radiators, etc. Capital, $30,000. Incorporators, E. L. Yocum, C. H. Lyford, H. A. Smith.

Fostoria Iron and Pipe Company, Fostoria, Ohio. Manufacture and sell iron pipe and do foundry business. Capital, $10,000. Incorporators, M. Levy and others.

Clark Motor Company, Buffalo, N. Y. Manufacture automobiles, motors, engines, etc. Capital, $50,000. Incorporators, S. B. De Long, J. W. Van Allen, H. J. Rente.

Elgin Separator Sales Company, Newark, N. J. Manufacture cream separators, etc. Capital, $250,000. Incorporators, Cyrus C. Morrow, Orlin Kanouse, A. B. Johnson.

Pioneer Paper Company, Pioneer, N. Y. Manufacture and deal in paper. Capital, $150,000. Incorporators, W. D. Loucks, G. G. Schieffelin, H. R. Gifford, Schenectady.

National Metallic Hose Company, New York. Manufacture hardware and hardware supplies. Capital, $150,000. Incorporators, J. A. Watt, C. E. Trulock, G. B. Walbridge.

Winans Machine Company, Binghamton, N. Y. Manufacture and deal in machinery, tools, etc. Capital, $75,000. Incorporators, T. J. Winans, D. W. Winans, C. J. Knapp.

Acetylene Accessories Company, Cleveland, Ohio. Manufacture water heaters, gas burners, etc. Capital, $10,000. Incorporators, F. L. Hopkins, A. C. Streich, E. L. Davis, etc.

General Tire Company, Cincinnati, Ohio. Manufacture automobile tires and auto accessories. Capital, $10,000. Incorporators, A. V. Boettles, J. H. Marvin, Philip Eid, etc.

Cleveland Automobile Spring Company, Cleveland, Ohio. Manufacture automobile springs and motor-car accessories. Capital,

$2000. Incorporators, Christian Girl, John B. Hull, Ernest W. Farr, etc.

Essex Storage Battery and Supply Company, Newark, N. J. Manufacture electric motors, dynamos, etc. Capital, $25,000. Incorporators, L. Simon, H. H. Lipkowitz, Jas. J. McManus.

Tungsten Lamp Repair Company, East Orange, N. J. Manufacture electric motors, dynamos, batteries etc. Capital, $50,000. Incorporators, H. E. Verpoilier C. O. Geyar, F. E. Ruggles.

Hartman Circuit Breaker Company, Mansfield, Ohio. Manufacture electric machinery, apparatus and supplies. Capital, $10,000. Incorporators, Wm. Bowers, E. R. Hartman, J. E. Epson, etc.

Williamson Garage Company, New Brunswick, N. J. Automobile garage. Capital, $50,000. Incorporators, W. M. Williamson, New Brunswick; N. H. Smith, 345 Bergen avenue, Jersey City.

Preston Leather Company, Newark, N. J. Manufacture leather goods. Capital, $100,000. Incorporators, T. F. Preston, 10 Ferdon street, Newark; Jas. L. Mason, 86 Hawthorne avenue, East Orange, etc.

Compressed Gas and Manufacturing Company, Cleveland, Ohio. Manufacture gas compressors, gas fixtures. Capital, $10,000. Incorporators, G. Cook Ford, W. S. Searles, John H. Watson, Jr., etc.

The Uraniumite Company of America, Buffalo, N. Y. Manufacture and deal in metals, alloys, etc. Capital, $400,000. Incorporators, W. L. Bechtold, H. E. Nichols, Buffalo; H. C. Mather, Hamburg.

National Indicator Company, Newark, N. J. Manufacture indicating devices for cars, railroad trains, etc. Capital, $500,000. Incorporators, J. S. Bizel, G. H. Lenney, L. A. Meyer, E. B. Webb, Bound Brook.

Jordan Specialty Company, Jordan, N. J. Manufacture and deal in sheet-metal specialties and novelties. Capital, $50,000. Incorporators, J. A. Jones, J. W. Edgbert, Auburn; T. L. Webb, Jr., Syracuse.

Marquette Aëroplane Company, Indianapolis, Ind. Manufacture and deal in passenger and freight vehicles for land, water and air. Capital, $10,000. Incorporators, M. A. Marquette, J. A. Johnson, Frank A. Lauck.

Knobbs Company, Elizabeth, N. J. Manufacture car trucks and car brakes and other appliances for steam and electric cars and engines. Capital, $50,000. Incorporators, C. J. Knobbs, G. L. Hirtzel, A. J. David.

Schalkenbach & Budke, Inc., Jersey City, N. J. Manufacture structural and general iron work. Capital, $125,000. Incorporators, R. N. Schalkenbach, G. H. Budke, Nannet, N. Y.; C. Schlegel, Jersey City, etc.

Eastern Safe and Vault Company, New York. Manufacture and deal in safes, vaults, etc. Capital, $200,000. Incorporators, W. H. Phelps, 7 North Fifteenth street, East Orange, N. J.; W. H. Smith, 400 Broadway, New York, etc.

Cook & Wilkinson Company, New York. Manufacture and deal in wagons, automobiles, etc. Capital, $25,000. Incorporators, W. M. Blain, 356 Henry street, Brooklyn; Geo. E. Cook, 69 West One Hundred and second street, L. M. Wilkinson, 520 West One Hundred and Fifty-first street, New York.

## TRADE CATALOGS

Roth Bros. & Co., Chicago, Ill. Bulletin No. 182, describing motors and dynamos. Illustrated, 16 pages, 6x9 inches.

Universal Fluxine Company, Urbana, Ohio. Pamphlet entitled, "The Art of Brazing and Soldering." 16 pages, 3½x6 inches.

The Bristol Company, Waterbury, Conn. Bulletin No. 124, illustrating and describing atmospheric-recording thermometers.

Rockwell Furnace Company, 26 Cortlandt street, New York. Bulletin M, describing tilting crucible melting furnace. Illustrated.

Pawling & Harnishfeger Company, Milwaukee, Wis. Folder illustrating and describing horizontal boring and drilling machine.

Boston Gear Works, Norfolk Downs, Mass. Catalog E3, describing steel, spur, bevel, miter and helical gears, racks, etc. Illustrated, 94 pages, 3½x6 inches, paper.

Smooth-On Manufacturing Company, Jersey City, N. J. Catalog No. 9, describing iron cements, sheet packings, corrugated metal gaskets. Illustrated, 96 pages, 4½x6½ inches, paper.

Landis Machine Company, Waynesboro, Penn. Catalog of bolt-threading, pipe and nipple threading, bolt-pointing and nut-tapping machinery, etc. Illustrated, 48 pages, 6x9 inches, paper.

## FORTHCOMING MEETINGS

National Machine Tool Builders' Association, spring convention, May 24-25, Rochester, N. Y. Charles E. Hildreth, Worcester, Mass., secretary.

American Society of Mechanical Engineers, spring meetings, Atlantic City, N. J., May 31-June 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

## WANT ADVERTISEMENTS

*Rate 25 cents per line for each insertion. About six words make a line. No abbreviations. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.*

### Miscellaneous Wants

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

I want manufacturer (royalty basis), for automobile accessory; demand heavy; good margin of profit; no experimenting. Address P. O. Box 112, Anderson, Ind.

Wanted—To manufacture small machines, or parts; punch press, screw machine, lathe, shaper and multiple drill spindle work quoted on at reasonable prices. Joseph Pollak, 215 Sydney St., Dorchester, Mass.

Experienced firm in Vienna, Austria, is open to take charge of very high-class machinery, machine tools, apparatus, etc., for Austria-Hungary. Write to "H. 2373" a Haasenstein & Vogler A. G., Vienna, I.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

We are about to complete a large contract and are, therefore, in a position to take up the manufacture of fine instruments, parts for the same, dies and jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

### Help Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Petersboro, Ont.

Wanted — Experienced mechanical draftsman and designer, with technical and practical training, for position in large Canadian concern manufacturing a number of heavy lines; sawmill and pulp mill machinery, boilers of all types, engines and special work; good prospects for right party; also wanted, two junior draftsmen with some drafting room and practical experience. Box 492, AMERICAN MACHINIST.

INDIANA

Wanted—First-class screw and turret lathe foreman; must be competent in uptodate methods and capable of getting results. Nordyke & Marmon Co., Indianapolis, Ind.

Wanted—Toolmakers, automatic screw machine operators, bevel gear operators for Billgram and Gleason machines; also a man with capacity as foreman for automatic and hand screw machine department, first-class man for case-hardening department, one experienced in

handling gears for automobile work; give age, experience and references. 423 Johnson Block, Muncie, Indiana.

MASSACHUSETTS

Wanted—Manufacturer's agent already representing staple lines to handle a line of high-class machine tools. Box 520, AM. MA.

MICHIGAN

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Wanted—Draftsman, experienced general and detail designer heavy machinery; good wages; steady employment with firm located in city of Detroit; state experience. Address P. O. Box 582, Detroit, Mich.

Wanted—One of the oldest and best established companies in the Middle West seek the services of a general foreman for their machine shop; about 350 are employed in the department, and building and equipment are thoroughly modern; the nature of the work varies from a line similar to automobiles and manufactured in large quantities, to a medium heavy plain class of railway equipment; none but high grade men apply, as the position is an important one and requires a man of broad experience. Box 415, AM. MACH.

NEBRASKA

First-class automobile machinists and toolmakers. Apply to C. M. Mohler, Ralston, Neb.

NEW JERSEY

Draftsman wanted by a Newark manufacturing company, for jigs, fixtures, die work and small parts; only first-class men need address Box 515, AMERICAN MACHINIST.

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands; also tool and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia).

NEW YORK

Wanted—First-class machinist to run Acme automatic screw machines; state experience in full and give references. Box 491, AM. M.

Wanted—Tool or die makers accustomed to very close and accurate work; first-class men only; good wages; steady position. Doehler Die Casting Co., Court & Ninth Streets, Brooklyn, N. Y.

First-class machinists and tool makers wanted; applicants must state wages desired and give previous experience in order to receive further consideration. Address Ingersoll-Rand Co., Painted Post, N. Y.

Wanted—Competent lathe, milling machine and vise hands; good wages and permanent employment for first-class mechanics who are temperate and industrious; references required. "Machine Tools," AMER. MACHINIST.

Wanted—Thirty machine shops in Rochester, N. Y., want 900 first-class machinists for steady positions; to efficient men wages $16.50 to $21 per week and 9 hours per day; open shop. Write P. O. Box 252, Rochester, N. Y.

Wanted—Toolmakers on model and experimental special automatic machine work; good pay and steady work to competent men; give age, experience and references. Apply: The S. S. White Dental Mfg. Co., Prince's Bay, N. Y.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

OHIO

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Foreman for die tool room; must be expert on dies for general line of sheet metal work. The Toledo Machine & Tool Co., Toledo, Ohio.

Wanted—Mechanical engineer or draftsman for designing and detailing; steady employment; conditions first class. The Toledo Machine & Tool Co., Toledo, O.

Wanted—Expert in factory cost systems and general accounting by prominent manufacturer in Cleveland; give references and experience. Box 493, AMERICAN MACHINIST.

Wanted—By Cleveland firm, several capable draftsmen, expert in motor-car work; only experienced men need apply; situation permanent to the right men. Address, stating experience, age, qualifications, etc., to Box 498, AMERICAN MACHINIST.

A prominent manufacturing concern in northwestern Ohio wants to engage a machine shop foreman who is up to the minute, is experienced handling men and who can get results; applicants please give references. Box 465, AMERICAN MACHINIST.

A large motor car factory in northern Ohio desires the services of a technical man who has had experience with gasolene motor cars and engines to assist in the experimental work; work is entirely in the testing of motors and various parts of the motor car, and only those men who have had experience in this line need apply. Address, giving full experience, etc., in first letter, Box 499, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Toolmaker for die sinkers tools. Western Tool & Forge Co., Brackenridge, Pa., Pittsburg district.

Wanted—A thoroughly competent and experienced laundry machinery designer and expert mechanic as shop superintendent. Box 522, AMERICAN MACHINIST.

Wanted—Several strictly first-class all-around machinists, thoroughly conversant with high-class automatic engine manufacture. Valley Iron Works, Williamsport, Pa.

Wanted—Mechanical draftsman able to design and make complete details of special boring and turning mills and other machinery. Write fully, giving experience and wages expected. Box 463, AMERICAN MACHINIST.

Foreman's assistant wanted in Philadelphia; must be experienced with tools for stamping, drawing and forming sheet steel; duties are setting dies in presses and handling a branch of press room; opportunity for a hustler, and one with ability for handling men to economically make articles from heavy sheet metal; one with bulldog stick-to-itiveness preferred; give age, experience and salary expected; answers kept in confidence. Box 494, AMERICAN MACHINIST.

Wanted—We have positions to offer from time to time for the following lists of first-class mechanics: Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

WISCONSIN

Wanted—A general foreman to take charge of factory employing 25 to 50 men on hardware specialties; must understand die work in all its branches; a permanent and growing position to the man that can make good. Address, stating age, experience and salary, Advance Manufacturing Co., Racine, Wis.

## Situations Wanted

*Classification indicates present address of advertiser, nothing else.*

ILLINOIS

Experienced, practical and systematic superintendent on large and small machine work, intends making change. Box 514, AMERICAN MACHINIST.

Mechanic, 38 years old, 20 years' experience as tool and die maker, held position as foreman the last 20 years, wishes position with reliable firm; either tool room or manufacturing department. Box 528, AM. MACH.

MASSACHUSETTS

Mechanic, age 35, six years' experience as foreman, superintendent and designer, good executive, 5 years in present position, desires change. Box 529, AMERICAN MACHINIST.

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 519, AMER. MACH.

NEW JERSEY

Position as machinery salesman or inspector, by young man with business and practical training. Box 527, AMER. MACHINIST.

Let me establish and superintend a piecework system in your factory and reduce production costs, or will consider position as cost accountant, purchasing agent, factory or office manager; twenty years' experience in metal manufacturing and smelting accounting and management; now employed, but desire more congenial locality, either in the East or West. Box 505, AMER. MACHINIST.

NEW YORK

Designer, experienced on automatic and special machinery, capable of taking charge of work. Box 524, AMERICAN MACHINIST.

First-class draftsman (26) desires change; technical graduate, experienced in gas engines; good jig designer. Box 517, AM. MA.

Young mechanical engineer, four years' experience, desires to connect with consulting engineer in New York City; industrial engineering preferred. Box 508, AMER. MACH.

Mechanical engineer, age 30, technical graduate, eight years' varied experience in shop, foundry and drawing room, desires change; East preferred. Box 530, AMER. MACHINIST.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 523, AMERICAN MACHINIST.

Salesman, machine tools or steel; fifteen years' practical experience as machinist, tool and diemaker; mechanical and technical graduate; thorough knowledge of scientific salesmanship; thirty-one years old. Box 518, AMERICAN MACHINIST.

Foreman or assistant superintendent; machine, manufacturing or tool work; good executive, systematizer, die, tool and fixture designer, reliable, original and practical man; age 34; New York City or vicinity preferred. Box 531, AMERICAN MACHINIST.

PENNSYLVANIA

An experienced electrical, mechanical and hydraulic engineer, technical education, desires position with company proposing to erect new plant, or modernizing present power equipment; can draw plans and specifications producing economic results. Box 521, AM. M.

WASHINGTON

Master mechanic, or assistant, desires position as above; up to date and a hustler; 28 years' experience; best of references; location immaterial. Box 526, AMER. MACH.

First-class mechanic, modern tool room and machine shop practice, desires position as shop foreman; held similar position; best of references; location immaterial. Box 525, AMERICAN MACHINIST.

WISCONSIN

Foreman open for engagement; successful in increasing production and reducing costs of manufacturing; executive ability; expert jig designer, will go anywhere; references. Box 495, AMERICAN MACHINIST.

Position wanted as a superintendent or general shop foreman in a large machinery manufacturing plant; I am 35 years of age, strictly sober and understand modern shop methods; have had lots of experience in handling men for over 14 years; understand designing Corliss engines, air compressors, ice machinery and tool and die work; will be ready to take position June 1; can give very best of references. Box 496, AM. MA.

## FOR SALE

For Sale—Interest or control in manufacturing business; exceptional opportunity for manager or instrument maker. Box 516, AMERICAN MACHINIST.

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; no foundry within 10 miles. Geo. H. Church, Bergen, N. Y.

For Sale—A complete Davis-Bournonville oxy-acetylene apparatus in first-class order; has been used about one year; can be seen at the Hartford Suspension Co., 150 Bay St., Jersey City, N. J.

Screw machines, three Hartford single spindle, can be seen running, one inch, one and one-half and two inch capacity, for sale or exchange for National-Acme multiple spindle. Warren Screw Co., Detroit, Mich.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.

# Tools and Fixtures Used in Making Dentists' Appliances

*Interesting Outfit of Small Tools, Jigs, Fixtures, Gages, Etc.*

By F. A. Stanley

In a previous article, a description was given of some of the processes followed in the shops of the Buffalo Dental Manufacturing Company, Buffalo, N. Y., for manufacturing dental vulcanizers. This establishment has a remarkably interesting outfit of small tools, jigs, fixtures, gages, etc, some of which are illustrated by the accompanying halftone and line engravings.

FIG. 1. THE BUFFALO DENTAL MANUFACTURING COMPANY'S TOOL VAULT

### A Tool Vault

A view showing a portion of the interior of the tool vault is presented in Fig. 1, which brings out distinctly an important feature in connection with the storing and handling of the tools. As here illustrated, a large number of shelves or shallow drawers are provided for carrying wood blocks of various sizes, in which sets of tools are placed, to be checked out as required by the workmen. Every operation upon a given piece has its complete outfit of cutting and gaging tools, which are grouped in one of these wood blocks, and where the work is not too large, the jig, or fixture, is carried by the same block. The sections, or shelves, which slide in and out readily, are located by letter and number and a card index covers the entire equipment, so that any set of tools may be found immediately upon reference to the card file.

### Arrangement of Tool Outfits

The method of grouping tools in their wooden holding blocks is well shown by Fig. 2, which illustrates three distinct sets for accomplishing respectively, drilling, milling, and screw-machine operations. The block for the milling tools carries all of the cutters required, the fixture for holding the piece, the gages for testing it, and the sample part. Similarly, the set for the drill-press operations includes drills, counterbores, reamers, taps, etc., and the set of tools in the screw-machine block is also complete in itself for machining the given piece. It will be noticed that each holding block is marked plainly with the name of the part to be machined and the operation number, and the location of the tools in the cabinets in the vault is also given. All of the tools in these equipments are kept in proper condition by adequate inspection, and whenever a workman takes out a set of tools, he knows that it is in good order and that everything is included which he requires for the job in hand.

### Some Accurate Drilling Jigs

The greater part of the jigs used here are for small work, and they are beautiful specimens of the toolmaker's art; not only are they accurately made, but every convenience for operation is incorporated in their construction. The three jigs in Fig. 3 are used in the manufacture of automatic pluggers, employed by dentists in putting gold fillings into cavities. The plugger will be recognized by machinists and toolmakers as an instrument similar in action to the automatic center punch, which is so commonly used in recent years. The internal construction of the plugger is shown in Fig. 4. An assembled plugger and different parts are shown in the foreground of Fig. 3.

### Drill Jig Features

The jig shown at *A*, Figs. 3 and 5, drills the rivet holes in a small latch,

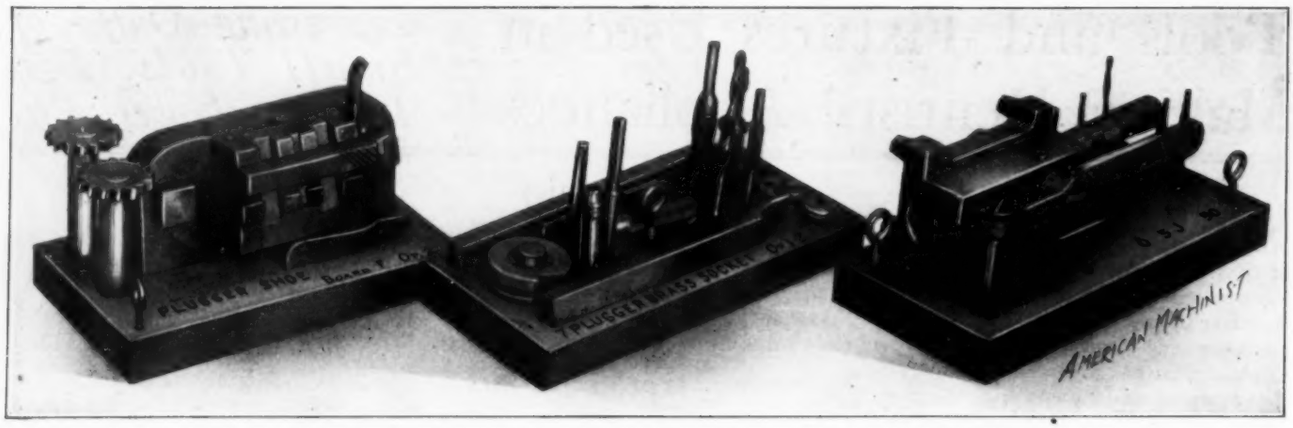



FIG. 2. SETS OF TOOLS FOR MILLING, DRILLING AND SCREW-MACHINE OPERATIONS

which forms a part of the interior mechanism of the plugger. The shape of the piece will be understood upon inspection of the engraving, Fig. 4, where the catch is shown at *a*. It is located and secured in the drill jig between two stops and with its heel against a shoulder against which it is pressed by a sliding jaw, actuated by the nut *B*. The jig leaf carries the drill bushings and when snapped shut is secured by the catch at the end of the jig body. When this catch is pressed with the thumb, a spring under the leaf throws the jig open for the removal of the work.

The jig *C*, Figs. 3 and 6, drills the corresponding hole in the outer shell or case of the plugger for locating and attaching a shoe *b*, Fig. 4, which engages with the latch drilled in jig *A*. This shell has an internal slot or guide groove and the hole for the shoe must be drilled in a given position relative to this slot and also must be a given distance from the end of the shell. In locating the piece in the jig, it is slipped over a key in the supporting arbor, as shown in Fig. 6, the catch *D* springing down sufficiently to allow the work to be slid into place, the shell is then pressed back against the heel formed on this spring catch, which thus serves as a locating stop endwise, and the nurled-head plunger *E* at the right-hand end of the arbor is pressed inward with the top of the finger to expand three jaws *E'* against the interior of the work, gripping it sufficiently to hold it in position during the drilling operaton. When the small plunger is pulled out with the fingers, its tapered point allows the expanding jaws, which are formed integrally with flat-spring bodies, to spring toward the center and the work may then be removed by simply depressing the spring stop *D*. In Fig. 3 another stop is shown in front of the jig for a different size of plugger shell, which requires a different location for the small screw hole drilled in this jig. The stops are readily changed to suit the work to be drilled. The extra stop is ordinarily kept in a pocket drilled in the base of the jig as indicated by dotted lines in Fig. 6, the end of the opening being closed by a small nurled-head screw.

### DRILLING A PIN HOLE IN TWO PIECES

The jig *F*, Figs. 3 and 7, locates a small, fork-shaped collar *G*, Fig. 4, upon plunger *H* while the pin-hole is drilled through both members. The plug *H*, to which the part *G* is to be secured, is located correctly in the jig by being pressed endwise against a stop gage placed between the work and the nurled-head screw *I;* piece *G* is located endwise by a pocket in the jig, and is held correctly with its guide notch in vertical position, by a pilot projecting below the under side of the jig leaf. It takes but a moment to put the two parts in the jig, close the leaf, drill the hole and remove the work.

It will be noticed that thumb and finger grooves are milled in the sides of

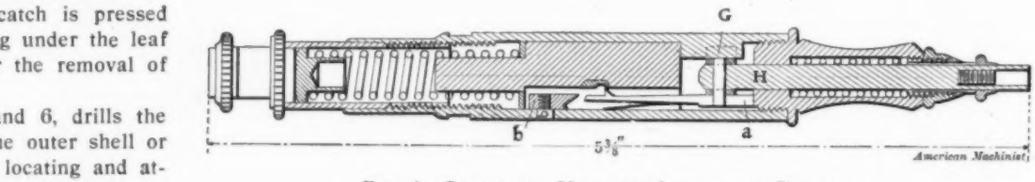



FIG. 4. SECTIONAL VIEW OF AUTOMATIC PLUGGER

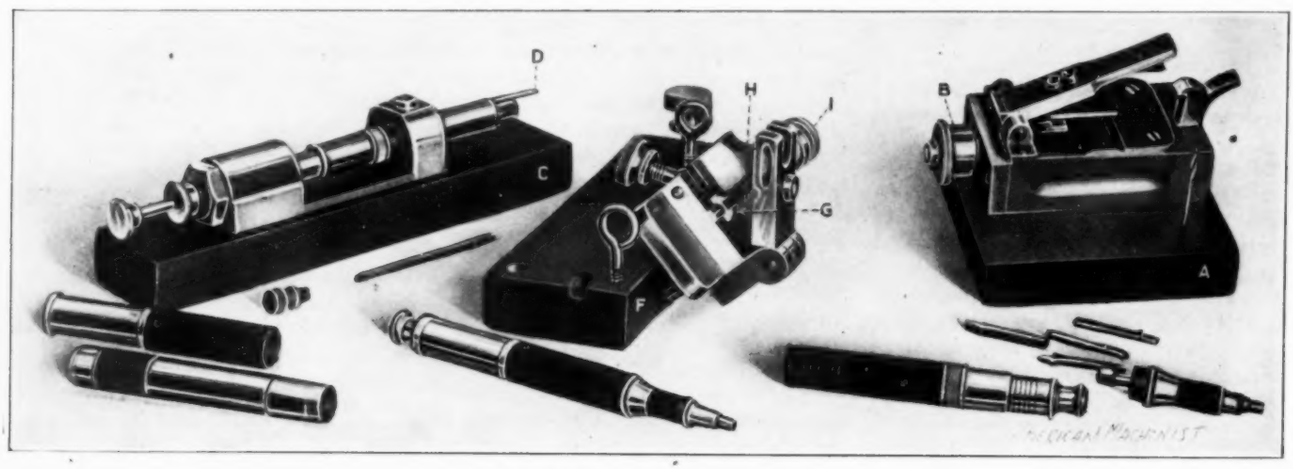



FIG. 3. SMALL DRILLING JIGS

the jigs to enable them to be handled readily. As shown, these small jigs are provided with hardened and ground feet inserted in the corners, and every part is neatly and accurately finished.

### Some Larger Jigs

A jig is illustrated in Fig. 8, at *J*, for drilling holes in a casting *K* known as a melting stand. One of the holes in this piece is drilled at an angle and the base of the jig is therefore machined at a corresponding angle, so that by placing it in the two positions on the base, the correct angular location is obtained for the holes. The two holes *L*, in front at the top for attaching connections, are drilled by turning the jig over flat on its back. The small hole *M* is reached by passing the drill through a cored opening in the bottom of the casting, which, as will be observed, is held in the jig bottom side up.

The jig at *N*, Fig. 8, is for handling a foot-blower base, which is a casting of peculiar form, as will be seen upon inspection of the piece *O* shown in front of the jig. Certain holes in this casting are required to be drilled at an angle with the base, and after the holes which are put through straight are completed, the jig is adapted for the oblique drilling operations by removing the supporting pieces *P* and *Q* from the sides of the jig, allowing the latter to tilt to right and left, to give the necessary angle. In the two angular positions thus secured, the jig rests upon the bearing at the center and the shallow ledge at the end. The supports *P* and *Q* referred to are held in place when in use by a tongue projecting from the face near the upper edge, which fits a corresponding groove in the narrow ledge forming the end of the jig body.

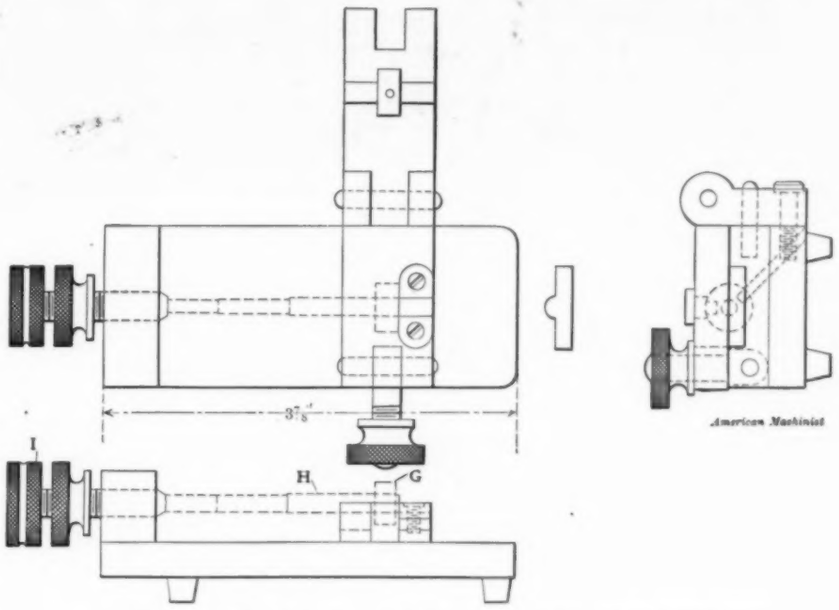



Fig. 7. Jig for Drilling Collar on Shank of Plugger

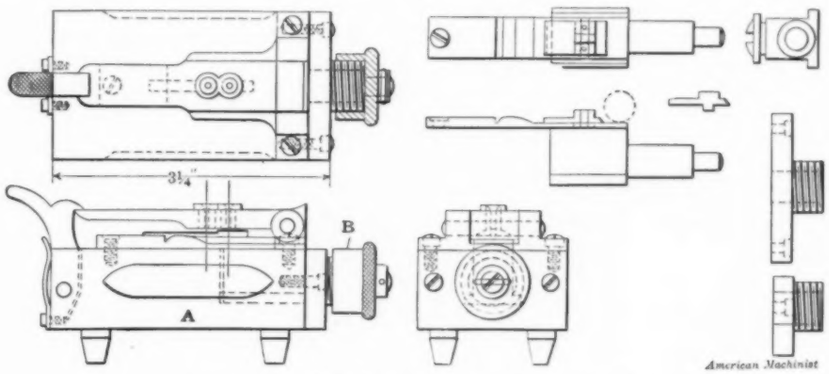



Fig. 5. Jig for Drilling Plugger Latches

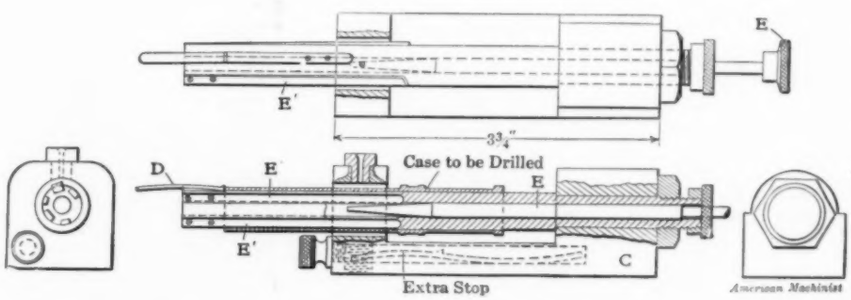



Fig. 6. Jig for Drilling Shoe Hole in Plugger Case

### Flush Pin Gages

A type of gage used extensively in this plant is the flush-pin device, two forms of which are shown in Figs. 9 and 10. For gaging depths of recesses, which must be accurate, hights of shoulders and for similar operations, the flush gage is a handy and valuable appliance. As made here, the bodies are nurled neatly and are of sufficient size to be easily handled. A single-pin gage is seen in Fig. 9, while the one in Fig. 10 has two internal gaging members and gives relative locations of three surfaces with the one gage. The piece on which this tool is used has, as shown, a machined central hub, a faced shoulder outside, and an internal seat, which must be to exact depth below the upper face. The gage, when put in place and pressed down, rests with the middle sleeve or tube *a* on the upper face of the work, while the external sleeve *b* goes down against the outer shoulder and the central plunger *c* against the internal seat. If the upper faces of the three members of the gage are flush with each other, the work is correct.

### A Tapping Fixture

Wherever possible, parts requiring tapping are held in suitable fixtures, and Fig. 11 represents such a fixture located on the table of a Garvin tapping machine by means of two parallel strips clamped at right angles to each other. When once set the fixture brings each piece into proper position relatively to the spindle for the tapping of the hole. The work tapped in the fixture shown under the spindle will be seen on the table to the left of the fixture.

A smaller jig is shown to the right, which is a combined drilling and tapping jig for a very small piece. In drilling these parts a steel block for guiding the drill is secured in the rectangular opening shown in the top of the jig. For tapping, the drill guide plate is removed.

### Fixtures for Handling a Wooden Piece

The halftone, Fig. 12, shows a fixture set up on the table of a Quint turret

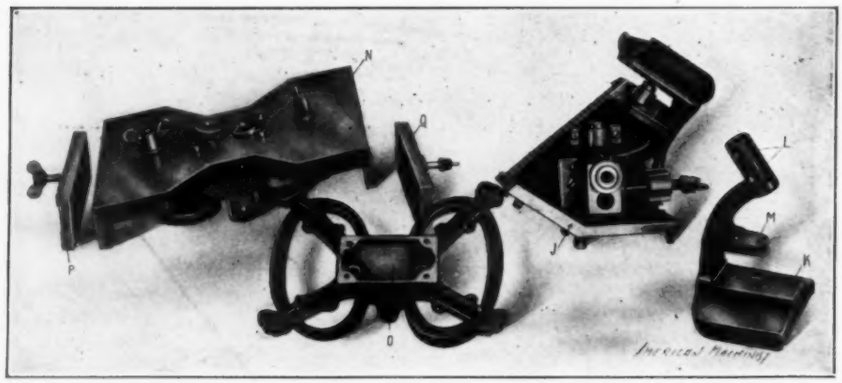


FIG. 8. DRILL JIGS FOR AWKWARD CASTINGS

drill, which is used in drilling a small hole and drilling and counterboring a larger hole in a small elliptical wooden block, used as the base and top of a foot bellows. The fixture base carries a sliding plate, which can be moved between two stops to give the required spacing between the two holes in the work. The fixture is set with the center line of its slide coincident with the centers of the turret spindles and when one hole is drilled and the next tool brought into position, the slide carrying the work is pushed back against the stop, and the two holes are thus correctly located on the minor axis of the ellipse.

### SCREW MACHINE PRACTICE

In connection with the manufacture of small parts on hand screw machines, there are various features of interest, some of which are shown in Figs. 13 and 14. The first of these illustrates a knock-off for threaded work on which second operations are to be performed, and which would be difficult to remove from the holder, unless some special releasing device were provided. This knock-off consists simply of a plug held in a draw-in collet, and having at its outer end a threaded hole to receive the work, while it carries also a collar with a lug on one side, against the face of which collar the work is screwed up tight when set for the second operation to be performed on the outer end. After the piece is turned, threaded, etc., the cross slide of the machine is brought forward, so that the stock carried in the tool post will engage with the lug on the releasing collar. In Fig. 13 a holder for a left-hand thread is shown in use and to release the piece

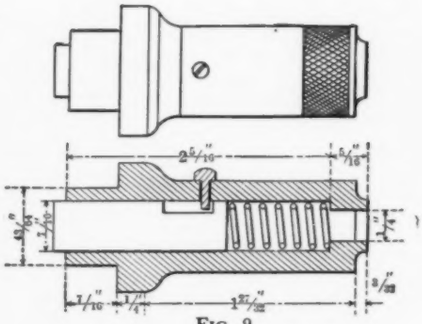


FIG. 9

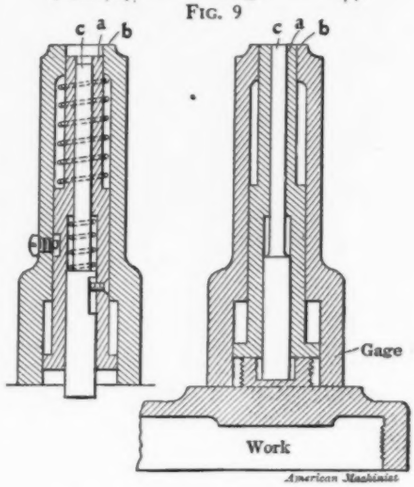



FIG. 10. FLASH-PIN GAGES

the stop in the post is brought under the lug of the work holder, while the spindle is turning ahead. This causes the collar to turn the work free in the threaded socket and the piece may then be readily

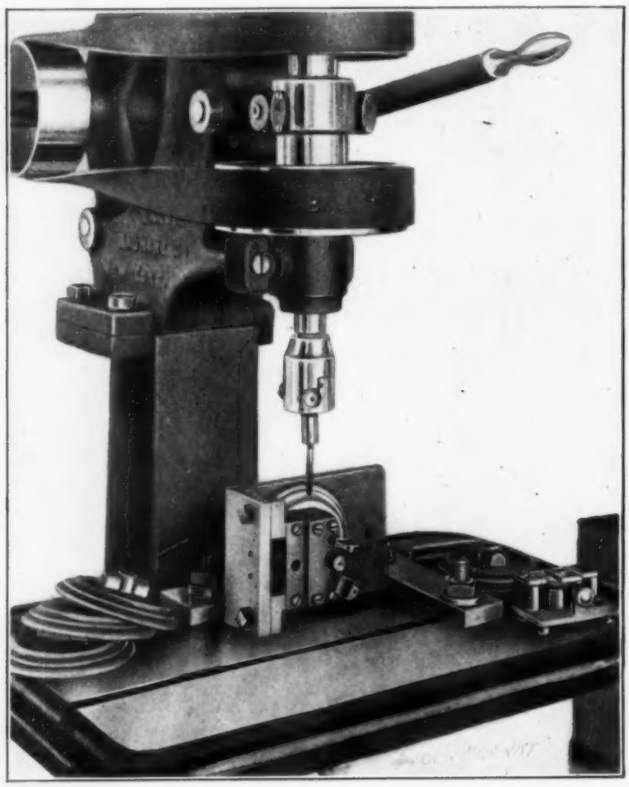


FIG. 11. A TAPPING OPERATION WITH SPECIAL FIXTURES

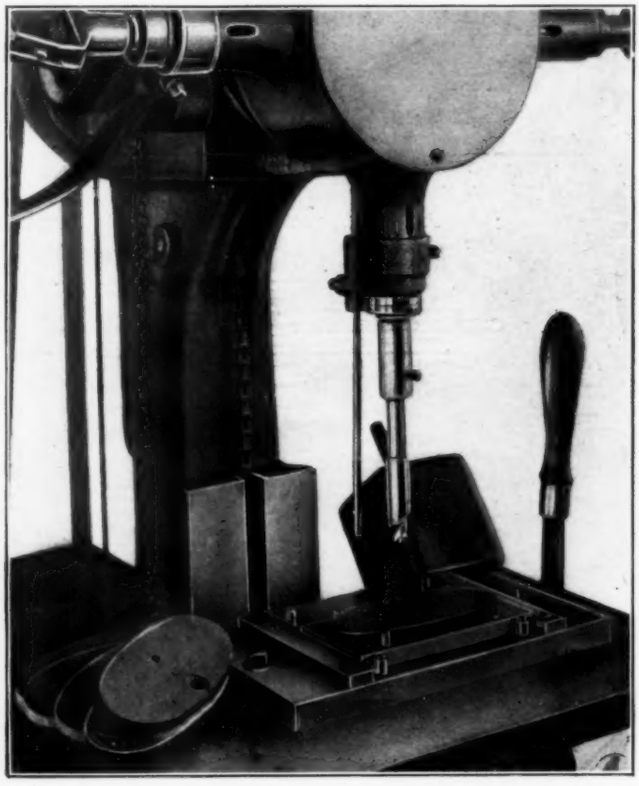


FIG. 12. DRILLING FIXTURE FOR A WOOD BLOCK

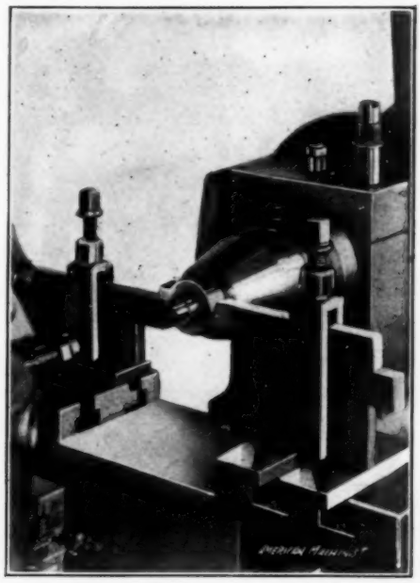


FIG. 13. "KNOCK OFF" FOR THREADED WORK IN THE SCREW MACHINE

removed with the fingers. Where the work has been threaded right hand, and a right-hand work arbor is used, the spindle is, of course, turned backward to release the piece, by bringing the lug on the knock-off collar against the under side of the stop in the tool post.

REVERSING DEVICE AND DOUBLE STOPS

All of the smaller screw machines in this department are arranged so that they may be reversed without the use of a hand shipper lever. Fig. 14 shows the general scheme as applied to a Pratt & Whitney machine. The foot lever actuates a spring-controlled countershaft mechanism, which enables the operator to reverse the spindle by touching the treadle with his foot. This movement allows the countershaft attachment to throw the reverse instantly to start the spindle backward. Movement of the treadle again reverses the counter and starts the spindle forward.

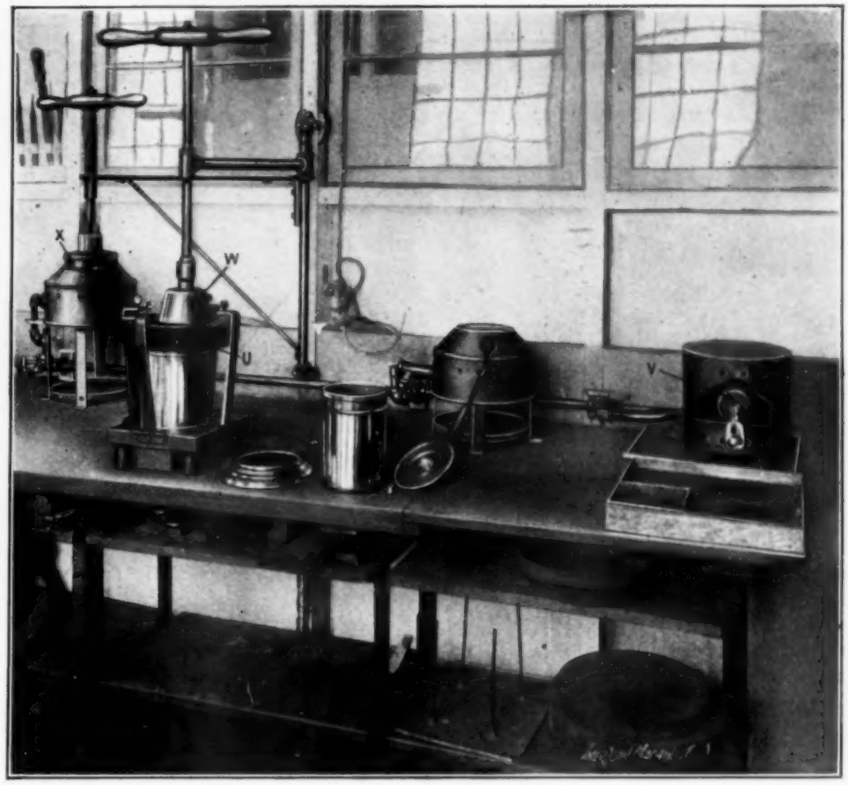



FIG. 15. A SOLDERING BENCH

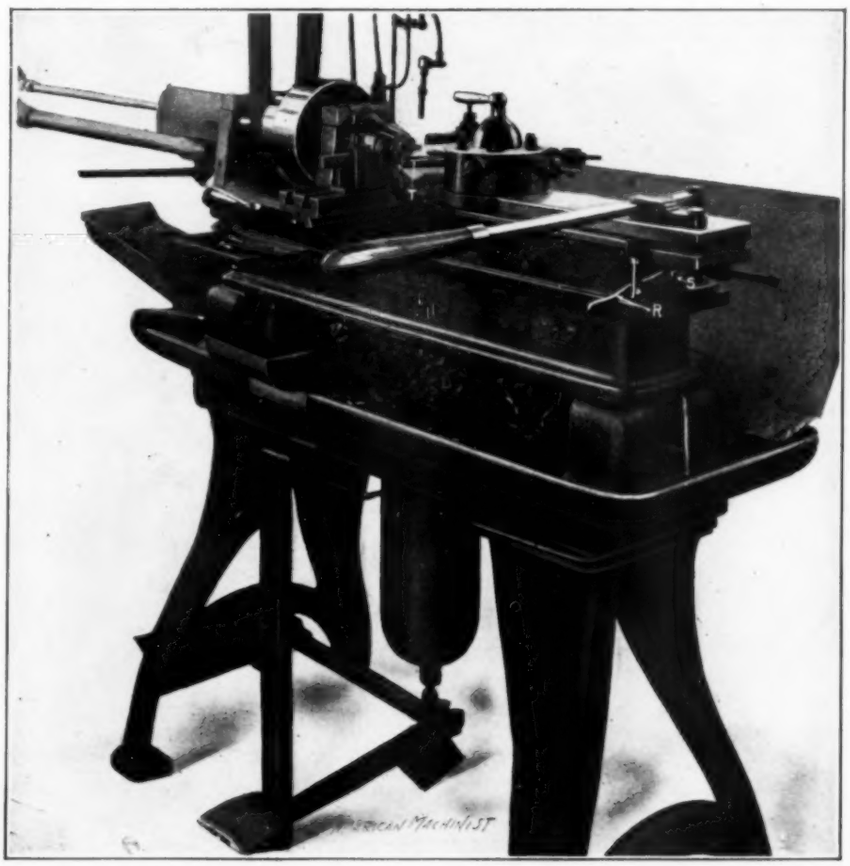



FIG. 14. SCREW MACHINE WITH DOUBLE STOPS AND QUICK-ACTING COUNTERSHAFT

Another feature brought out in this illustration is the double stop for the turret slide, which will be seen at *R*. This comprises a lever of flat section, pivoted on the rear end of the turret slide block and having at the outer end a handle by which it may be elevated, to bring a hardened button *S* into line with the stop screw attached to the turret slide. If it is desired to move the turret slide forward to two different positions with a definite stop for each, it is merely necessary to leave the lever in its lower position for stopping in one case, and swing it up for the second stop.

A tool will be noticed at *T* in the turret which serves as a stock stop and also as a counter-sink. The counter-sinking tool, when not in use, slides back in the hollow stop far enough to clear, when the bar material is fed out against the end of the stop. When in the series of operations the counter-sink is required, the pin handle shown is pulled forward and turned into the retaining notch near the end of the stop, thus locking the counter-sink in working position.

### Soldering Apparatus

One of the products of the company is a gasolene gas generator, made of sheet brass, and consisting of a cylindrical shell soldered to a base and having in the top plate, a piece known as a turret, which carries the nozzle connections, and which is also soldered in position. A flange is soldered around the outside. Several of the metal parts are illustrated on the bench in Fig. 15. The top is placed on an aluminum ring set in the plate on the bench, and the cylindrical shell put in proper position and clamped down as at *U*. The soldering iron at *V* which is heated in the manner indicated, is used in soldering the turret in the cover and the heavy soldering iron *W* is then swung over the work and pushed down to the bottom to melt several pieces of solder which are dropped in, and which, in their fluid condition flow all around the joint between the cylindrical body and the flat top. The bottom and flange are soldered with the iron *X*, which is supported by a spring on the swinging arm. Before the generator shell is fitted to the top and base it is tinned by dipping and this, with the small pieces of solder dropped into the bottom allows a good joint to be made very quickly. The heavy irons *W* and *X* are easily handled with their swinging supports by means of which they are moved readily between the heating apparatus and the work.

The soldering tools have iron heads in place of copper, it having been found on this work that better results are obtained with this construction. The ring upon which the work rests is of aluminum as stated, to prevent surplus solder from sticking to the ring.

# Special Tools for Railroad Shop Work *Editorial Correspondence*

In the Baltimore & Ohio Railroad shop at Cumberland, Md., there are several interesting machines that are used in their work. The designing and building of these are due to G. F. Weiseckel, the master mechanic, and J. O. Bushyaeger, the foreman of the machine shop. Three of the machines are shown in this article, and while they are largely built of scrap material that was picked up around the shop, they are still very powerful and perform the work for which they were designed.

The machine shown in Fig. 1 is for forming the heads on rivets by squeezing, and uses the compressed air from the regular shop supply. It is built of angle and channel iron; an air-brake cylinder that was discarded from an engine, and other materials that were taken from the scrap pile.

In Fig. 2 are shown the details of the machine, and here can be seen the part that is under the floor in Fig. 1. This consists of an air-brake cylinder, to the piston of which is attached a long shaft that drives a sheave wheel that carries a ¾-inch wire rope. When the air is turned on, this pulls the lever over to squeeze the rivet sets together and form a head on the rivet. The tail block *A* of the machine can be moved back and forth on the channel irons and thus make the machine adjustable to any length of rivet up to 19 inches. The rivet sets are put in loose, so they can be taken out and others put in, that will fit any size of rivet up to 1½ inch. At *B B* are shown several sizes of rivet sets that are used in the machine.

### Operating the Riveter.

The machine is operated by a foot lever at *C* that is now pressed down and the air turned on. Thus the sets are in the position that they take when the rivet is squeezed up. At *D* is the air valve that is operated by the foot pedal, and the details of its construction are shown in Fig. 3.

The sheets are bolted together on horses in front of the riveters, and the holes reamed out with the pneumatic tool shown at *E*. They are then held up by an overload crane while the machine is doing the riveting. This work was formerly done by hand and required considerable skill and strength as well as creating a deafening noise. With the machine, however, the rivets are merely slipped into place and the foot lever pressed down.

This squeezes and forms the head much better than it was possible to do by hand. It makes a much tighter joint, owing to the machine being able to squeeze the rivets together with a greater force than it is possible to put into the blows of a hand hammer and it is all done with absolutely no noise. As simple and inexpensive as this machine is, it is capable of doing the work that it formerly took four hand riveters to do, and requires practically no skill in its operation.

### Rivet Cutter

The second interesting machine is the portable rivet cutter shown in Fig. 4. This somewhat resembles in appearance a rapid-fire gun, and like them, it shoots, although its shots are limited to one at a time.

In this case the piece that was to have the rivet heads cut off, was placed against one of the columns of the shop. The machine was then brought into position and a chain put around the column. To this was connected a wire rope that was attached to a reel on the back end of the machine. The cutting bar fits loosely, in a socket, in the end of the piston so that any size, shape or length of cutting bars can be used.

When the bar is in position against the head of the rivet and the machine reeled up to it, the air is turned on and enters the cylinder of the machine. The air then forces the cutting bar against

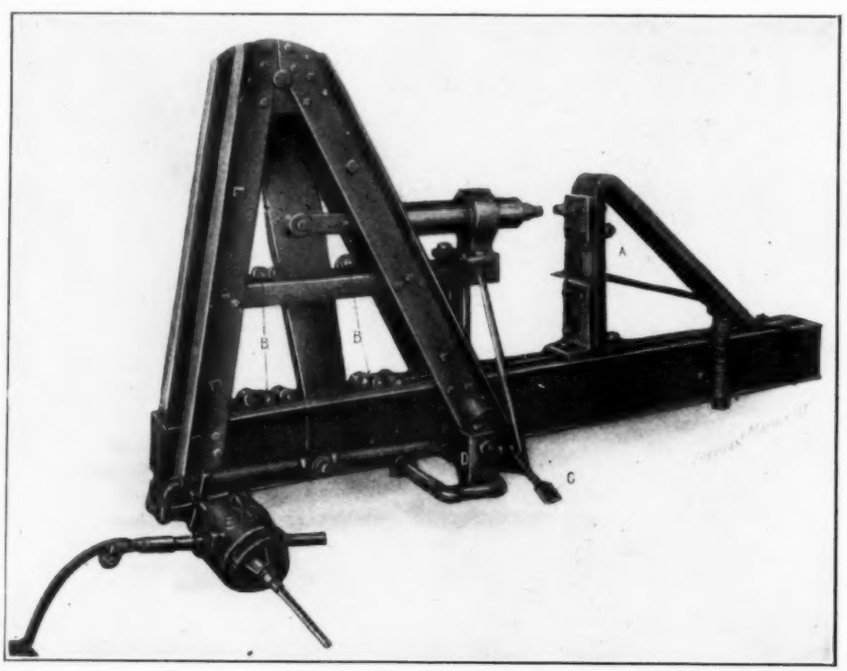



Fig. 1. Compressed-air Riveting Machine

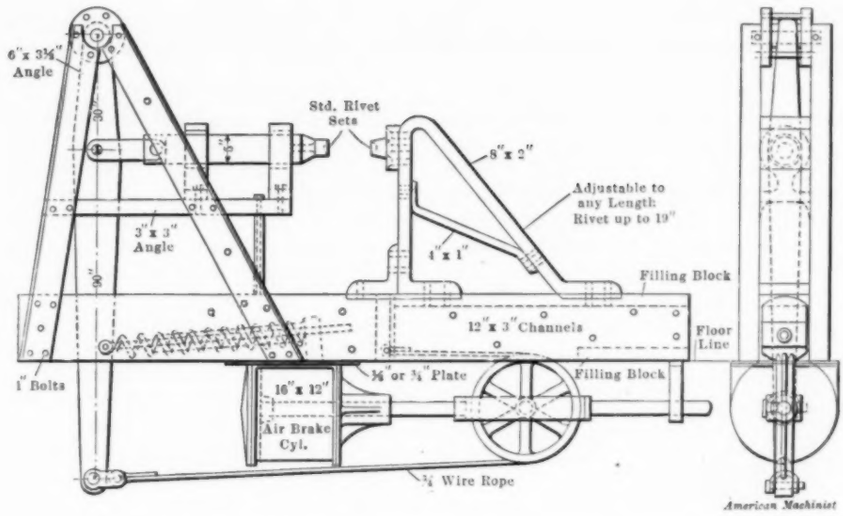



FIG. 2. DETAILS OF COMPRESSED-AIR RIVETING MACHINE

the head of the rivet and breaks it off. The rivet head is broken off instantaneously and those who have swung a sledge against a stubborn rivet that refuses to be cut off can appreciate the saving in time and strength that this machine has accomplished.

In construction it merely consists of a long cylinder, which in this case, was made out of a piece of pipe; a piston, with a socket in the end to hold the bars; a reel on the back end of the machine, and the necessary connections; the whole being mounted on a carriage as shown.

### SAW FOR PACKING

Another machine that is interesting is the double saw shown in Fig. 5, that was built for cutting metallic packing. This machine is built mostly of scrap angle iron lying about the shop and riveted together with two bearings bolted on the lower cross piece and a shaft two inches in diameter with a tight and loose pulley on the outside for driving. A three-inch belt and a 20-inch pulley inside the framework drive a 1½-inch shaft at the top with a saw at each end.

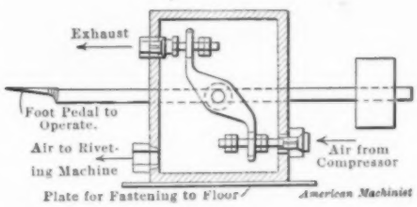



FIG. 3. FOOT VALVE FOR RIVETING MACHINE

These saws are made of 5/32-inch tool steel 6 inches in diameter and are not hardened. The teeth are filed ⅜ inch deep and ⅜ inch apart so as not to choke. They are protected with guards that have just enough opening to get two rings of packing in at one time. The plate about the center of the saw blades is smooth, with a slot large enough to clear the saw blades and is supported by

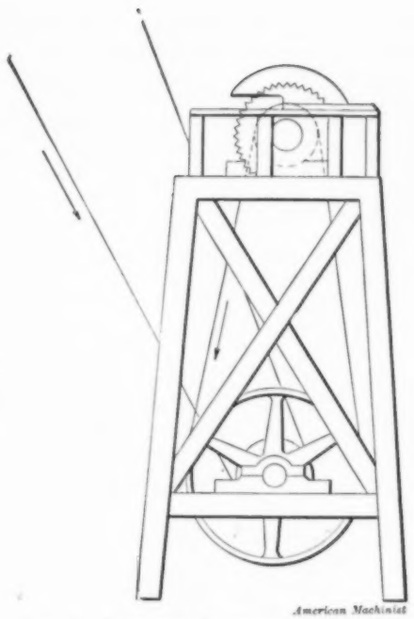



FIG. 5. SAW FOR CUTTING METALLIC PACKING

small columns which make it perfectly safe. The saws run at 1300 revolutions per minute.

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The first of the three concrete barges to be constructed for use in connection with the hydraulic operations in the Pacific division of the Panama canal was successfully launched on Wednesday, April 20. The completed barge draws about 3 feet of water, and when mounted with dredging pump, motor and equipment, weighing approximately 60,000 pounds, it is expected that it will draw an additional 9 inches. The amount of reinforcing material in the construction of the remaining two barges will be less than in the first, which will materially reduce the weight in the aggregate. One-half inch mesh No. 12 will be used in the wall construction of the other two barges, instead of ¼-inch No. 12.

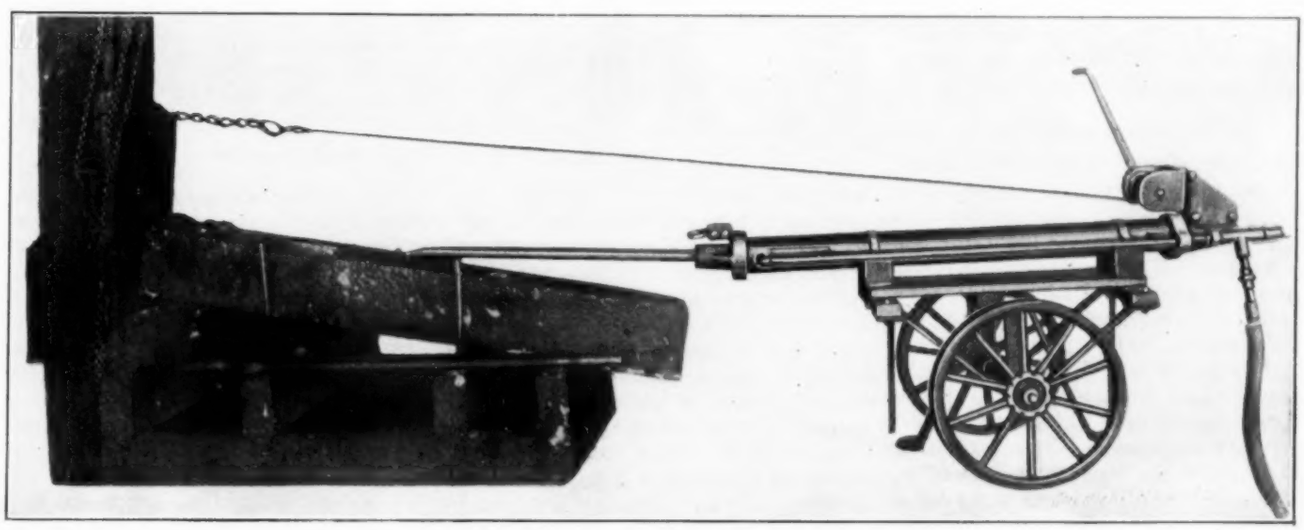


FIG. 4. PORTABLE PNEUMATIC RIVER-HEAD CUTTER

# A Rapid Swiss Dividing Machine

*By Alfred Gradenwitz*

The dividing machine constructed by the Société Genevoise pour la Construction d'Instruments de Physique et de Mécanique, Geneva, Switzerland, is intended for the accurate and rapid dividing of slide gages. As shown in Figs. 1 and 2 it is provided with two graduating points allowing two gages 35 centimeters in length to be divided simultaneously at a speed of 40 lines per minute.

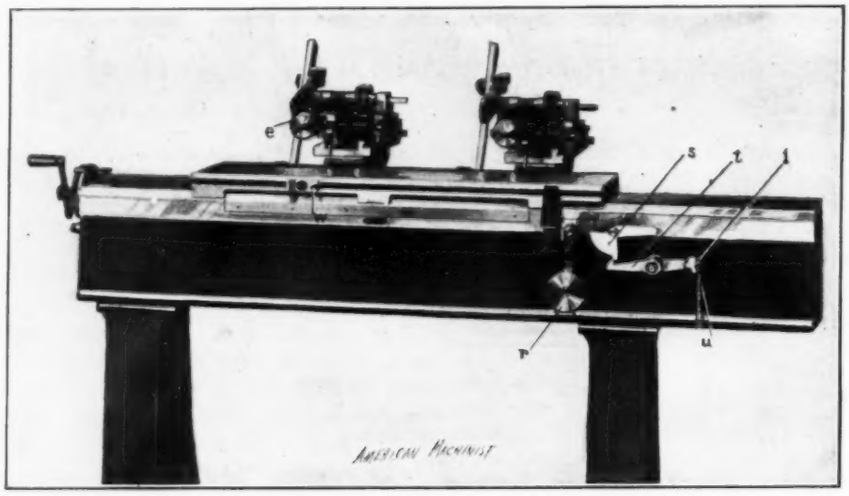



FIG. 1. FRONT VIEW OF GRADUATING MACHINE

The transmission of power to the machine is effected by the step-pulley *n*, Fig. 2, which is mounted loosely on the shaft *z*, and coupled to the shaft by means of the four-tooth clutch *m*, which serves to throw the machine out of gear automatically. The motion is transmitted by gearing to the graduating points. The difference in the lengths of the various lines is obtained automatically, each tenth graduation being made longer, the lines corresponding to the fives somewhat shorter, and these corresponding to the units, of normal length. This is assured by a spring device *f* while the movement of the crank-pin operating the cutting point remains constant.

### THE GRADUATING POINTS

The cutting point is designed for forming strong and deep lines when acted upon by the weight *e*. It may, however, be used as well for cutting very fine graduations. The maximum length of lines obtainable is 40 millimeters, and the shortest, one millimeter.

The tracing point is immovable, the work being moved. The price to be divided is fixed on the plate *c* which is shifted by the nut *d* mounted on the screw of the machine. The advancing movement of the plate is taken from the shaft *z* through the crank-pin *o* and rod *o'* which operate a pawl and a 100-tooth ratchet *b*, which actuates the screw.

### CONTROL OF OPERATING SCREW

The shortest distance between the graduations made by the machine is one-tenth of a millimeter, and the greatest distance 2 millimeters. The pitch of the screw is 10 millimeters so that even in the case of accelerated operations, it does not rotate too rapidly. A brake is provided for keeping the screw in position. Whenever one of the cutting points is to be thrown out in order to work with one point only, it is merely necessary to shift the crank pin *i* to the center of shaft *z'*, so that no motion will be imparted to the cutting point by the disk *k*.

This disk as well as the disk *a* is provided with a cross groove in which the crank pin can be shifted; thus the operator can control at will the reciprocating motion of the pin *o'* on the disk *b*. The position of the crank pin *o* is readily varied by means of a special scale, according as a millimeter, ½ millimeter, or 1/10 millimeter division is to be traced.

### AUTOMATIC RELEASE

The machine is thrown out automatically in the following manner:

On the front side of the machine is fixed a brass scale *x*, Fig. 1. The movable carriage carries a stop *w* provided with an index pointing to the scale just referred to. The zero of this scale is so situated that the moment the stop comes into contact with the lever *v*, the weight *r* by dropping on the piece *s* releases the detent, and the spring *u* disengages the clutch *m*, Fig. 2. The oscillations of the weight are controlled by a spring. During the operation of the machine the weight is swung vertically above its pivot.

The principal advantage of this dividing machine is that deep graduations can be made rapidly in hard steel in a single operation.

In a series of standardizing tests made on the machine at the Paris Conservatoire des Arts et Métiers, a scale of 50 centimeters was graduated, and the error at the end of the 50 centimeters was found to be only 25 one-thousandths of a millimeter, and the maximum deviation from one interval to another only 5/1000 millimeter. The machine has a device for accurately adjusting it to the total length of the scale to be made. The nut *d* Fig. 2, carries a vertical rod fitting into a groove at the bottom of the bed. If during the advancing motion of the nut *d* on the screw, this groove be absolutely parallel to the screw, it will exert no influence on the nut. If, however, it be oblique in one direction or the other, it will impart a rotary movement which is either added to or subtracted from the action of the screw. In this manner, the machine can be so adjusted that the correction of the scale at the 50th centimeter is 0 micron, though this adjustment obviously leaves the extremely slight errors of the intermediate divisions unaltered.

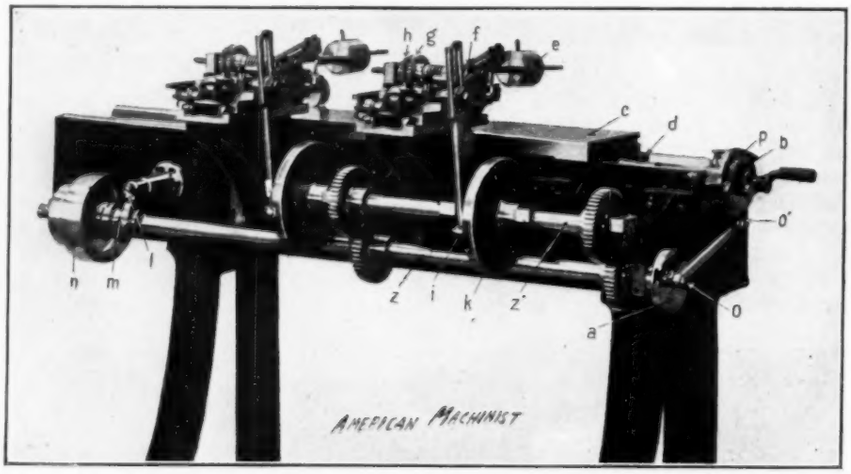



FIG. 2. REAR VIEW OF GRADUATING MACHINE

# Determining Efficiency of Electric Hoist Gearing

## *Spur Gear and Worm Gear Types of Hoists Equally Efficient*

By S. H. Libbey *

It is unfortunate that there is so little information available on the efficiency of gearing and at the same time it is surprising, for there is probably no other single mechanical device that has received as much attention from engineers and designers and concerning which so much has been written in the technical press. Therefore, a brief discussion of the efficiency of the gearing of the electric hoists built by the Sprague Electric Company, of Bloomfield, N. J., will be of interest and value.

The arrangement of parts in the worm-geared hoist is shown in the elevation Fig. 1 and partial plan Fig. 2. Upon the end of the motor armature shaft is a spur pinion meshing with a spur gear on the wormshaft. This wormshaft is held in two journal bearings and abuts against a ball thrust. Above the worm and, of course, in mesh with it is the worm gear in the form of a ring or rim bolted to a spider fixed on the rope-drum shaft. This drum shaft is held by two journal bearings and carries on each end a rope drum as shown in Fig. 2. As we are more particularly interested in the worm and gear, the worm is shown in detail in Fig. 3.

### The Ball Thrust

In passing it is worth while to consider the ball-thrust bearing which in one feature differs from accepted practice. The races are of low-carbon steel, case hardened and carefully ground to dimensions. The balls, instead of being of the hardness as furnished by the maker, are uniformly drawn to a temperature of 475 degrees Fahrenheit before being used in the bearing. This process produces a tempered ball and some three years of use have demonstrated the wisdom of the process for this particularly severe intermittent service.

### The Worms and Worm Gears

The line engraving, Fig. 3, shows a single-thread worm having a pitch diameter of 2.238 inches, a pitch of one inch and 29-degree thread. In some hoists another worm is used identical with the one shown except that it is double thread instead of single thread. All of these worms are made from open-hearth steel, are lathe cut and carefully case-hardened. The worm gears with which they mesh are hobbed from a special brass composition, that is very hard, tough and has demonstrated its wearing quality.

*Engineer hoist department, Sprague Electric Company.

### Testing the Hoists

Prior to shipment every hoist is run and given a test under full load, in which certain observations are taken. These observations include the current and voltage of the motor, from which can be computed at once the foot pounds input; the load on the lifting hook and the speed of lifting from which is computed the foot pounds of work done on the drums. The foot pounds of work done on the drums divided by the foot pounds of input gives the total efficiency of the hoist. This total efficiency divided by the efficiency of the motor for the noted voltage and current gives the efficiency of the gearing, the factor that we are particularly interested in here.

This efficiency of the gearing takes into account all of the losses from the pinion on the motor armature shaft to the load. Returning to Figs. 1 and 2, the included mechanism is seen to consist of a pair of spur gears, two journal bearings and one ball thrust bearing on the worm shaft, the worm and its meshing worm gear and two journal bearings on the drum shaft. To these might be added the friction loss of the rope upon the drums, and in the hook sheave.

Six hoists, two rope type with single-thread worms, gave the following values, respectively, for the efficiency of the gearing as outlined above; that is, obtained without running the gears or worms into condition, the gear being exactly as it comes from the hob, and the worm being only cleaned, not polished, after hardening: 49.7, 40.5, 45, 51, 42.6, 41.2, per cent. The average is 45 per cent.

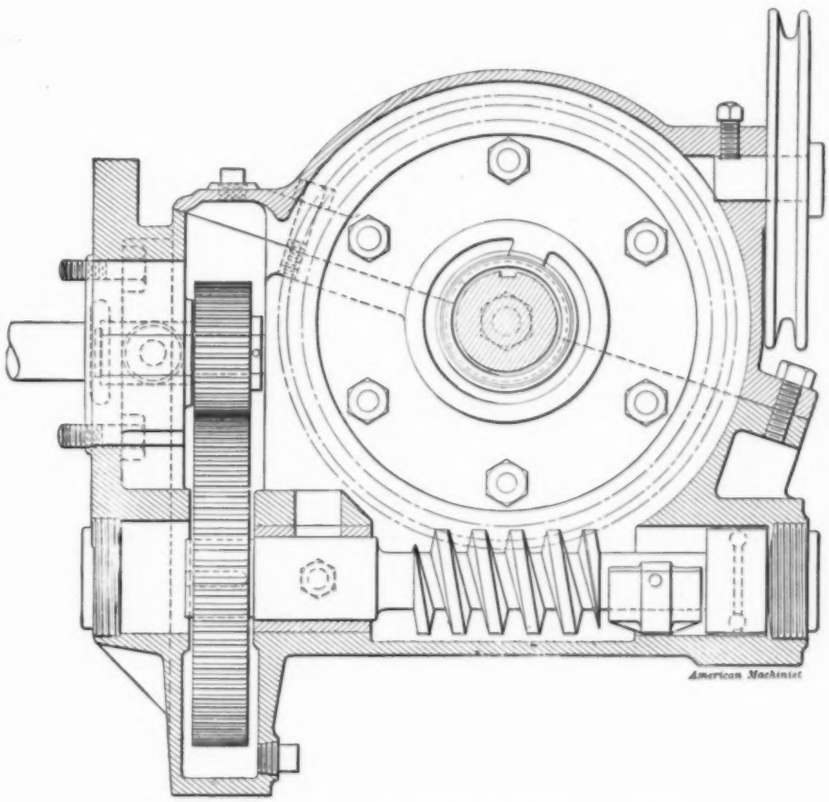



Fig. 1. Elevation of Gearing of Sprague Electric Worm-geared Hoist

Similarly three, two-rope type double-thread worm hoists gave the following percentages: 48, 54, 55.3; with an average of 52 per cent.

These averages show at once the advantage of increasing the thread angle of the worm. This angle in the case of the single-thread worm is 8 degrees 6 minutes, double-thread worm, 15 degrees 53 minutes.

In the work of F. A. Halsey, on worm and spiral gearing, is given a chart showing the relation between thread angle,

speed and efficiency for worm gears. The speeds of the worm at the pitch line, for all of the load speeds in the tests, that enter into the averages given in the preceding paragraphs, range from slightly less than 200 feet per minute to considerably over that speed. The highest curve on the chart in Mr. Halsey's book is for 200 feet per minute and a note states that it is undoubtedly safe to use this curve for all speeds in excess of that amount. Returning to the chart and reading from the curve for a velocity of 200 feet per minute at the pitch line, the efficiency corresponding to a thread angle of 8 degrees and 6 minutes is 82.5 per cent. This is for the single-thread worm.

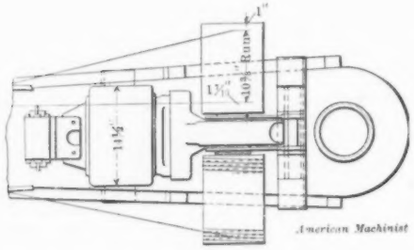



FIG. 2. PARTIAL PLAN OF HOIST, SHOWING ARRANGEMENT OF ROPE DRUMS

Similarly for the double-thread worm having a thread angle of 15 degrees and 53 minutes, the efficiency is 90 per cent.

As the mechanism included in the gearing of the hoist is identical for the two types with the exception of the worm, it follows that the losses in this mechanism other than those in the worm and gear must be the same. It further follows that if the performance of these worms agrees with theoretical and experimental investigations from which Mr. Halsey's chart was plotted, that the difference between the efficiency of the worm as found from the chart and the efficiency of the gearing as a whole must be a factor applicable to the balance of the mechanism. And if the losses for the mechanism other than the worm are found to agree for both the single-thread and double-thread worm types, it goes to prove that the performance of those worms must agree closely with the results upon which the chart referred to above was plotted.

As a matter of fact, such is the case. From the chart the efficiency of single-thread worm is 82.5 per cent. The corresponding average efficiency of the gearing is 45 per cent. The difference is 37.5 per cent., a factor applying to the mechanism other than the worm. In the case of the double worm, the efficiency from the chart is 90 per cent.; average efficiency of the gearing from the tests is 52 per cent., the difference is 38. This indicates that the performances of the worms are in close relative agreement with the results plotted in Mr. Halsey's chart.

### INFLUENCE OF USE ON HOIST EFFICIENCY

As a matter of interest it is worth while to note the increase of efficiency of the gearing of electric hoists after a period of intelligent use. It is seldom that a hoist comes back to the factory for repairs or for any other cause. Thus, comparative data as to the performance of hoists when new and after use are few. However, I can cite a few cases. In one a single-thread worm hoist showed an efficiency of 48 per cent. under its original shop test and an efficiency of 58 per cent. several months later. Again a single-thread worm hoist shows an efficiency of 45 per cent. under shop test and 64 per cent. several months later. In still another case a single-thread worm hoist showed an efficiency of 61 per cent. after several years of use. This hoist is one that has been in use in our own factory; was one of the first built and no record exists of its original performance. If we assume, however, that its original

particularly as it would greatly limit our output.

### NECESSITY OF CAREFULLY ADJUSTING WORM AND WHEEL

Another point of interest is shown by the result of three tests on a double-thread worm hoist that was originally set up without proper adjustment of worm and gear. After the hoist had been run under usual conditions, efficiency of the gearing was 51.5 per cent. It was believed that this was too low and an examination of the hoist showed that the worm was not central with its gear, and that its point of contact was at one side. The gear was then moved over 1/32 of an inch by squaring off the end of the hub, tested, and the efficiency was 54.2 per cent. It was believed that the worm and wheel were still not central and the gear was moved 1/32 of an inch more. When tested again the efficiency was 60.8 per cent. These tests show clearly the

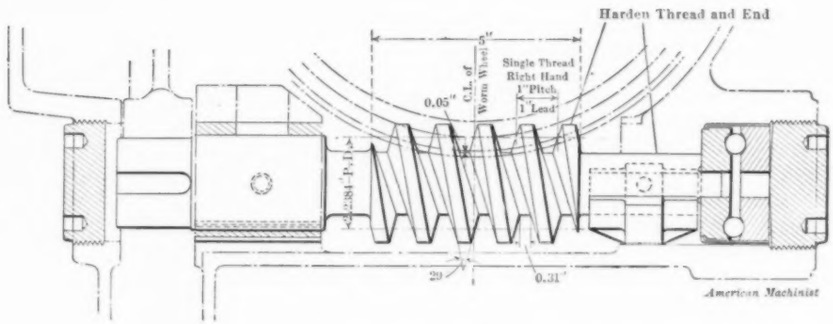



FIG. 3. DETAILS OF SINGLE-THREAD WORM FOR ELECTRIC HOIST

was about the average for single-thread hoists, namely 45 per cent., it will be seen that it has improved 16 per cent. during its period of use.

A double-thread worm hoist that has been used in our own factory and under similar conditions now shows a gearing efficiency of 81 per cent. If its original efficiency was at about the average for such hoists, say, 52 per cent., it will be seen that it has increased 29 per cent. during its period of service.

Referring again to the original tests; after a machine is put in the hoist way, the test readings are taken by running it up and down a few times, probably not over five or six, the readings determining the conditions of the machine, and the necessity of taking apart or continuing the test.

From the above it will be seen why the worm-geared hoist improved so much, after use. As a long period of running in the hoist way would only improve the conditions of the worm and gear, and consequently the efficiency, and would not show up any defects which the first readings taken would not show; it is, of course, not necessary to take the time such testing would make necessary, necessity of a proper adjustment of worm and its meshing gear.

### EFFICIENCY OF A SPUR-GEARED HOIST

By way of comparison I give the efficiencies of a 3-pair spur-geared hoist. These are: Total efficiency 62.7 per cent., and gearing efficiency 76.5 per cent. The losses due to the bearings and gearing are 23.5 per cent.

If we divide this by three we get approximately 7.6 per cent. as the loss in one set of spur gears and bearings, there being three sets in the train. Taking this 7.6 per cent. as an approximate loss for such gears and bearings, and deducting this from the losses shown in the double-thread worm-geared hoist after several years of service, reduces the loss in that machine to 11.4 per cent. (19—7.6) and gives an efficiency for the worm gearing alone of 88.6 per cent., which is not very far from Mr. Halsey's figure of 90 per cent.

It is also interesting to note that the total efficiency of the spur-geared hoist is but 76.5 per cent., while the corresponding efficiency of the worm-geared hoist is 81 per cent. The efficiency of the spur-geared machine will not im-

prove much if any after it is first tested, while the worm-geared machine will improve with use until its maximum efficiency is reached, remaining at that point until the parts are worn out. As an additional fact in connection with the above comparison, the total gear reduction of the spur-geared hoist was 30, while that of the worm-geared machine was 69.5, showing that the latter was working at a disadvantage as compared with the former.

From these figures it would seem that, with proper materials intelligently used, the spur gear has no advantage over the worm gear.

In closing it is to be pointed out, that while the efficiency of an electric hoist is important it is not of as great importance as reliability and durability, for the service to which these hoists are put is intermittent, which means that the power consumption is small and the effect of a slightly greater or slightly less efficiency is perhaps negligible. On the other hand, such hoists must be reliable and durable. They must always be ready for use and there must be no structural weakness that will require the replacement or repair of parts from time to time. Thus the question of efficiency in regard to these worms and gears is of importance as indicating a design that is serviceable and durable, rather than a design that is merely efficient from the standpoint of power consumption.

# An Interesting Bending Fixture Job

*Editorial Correspondence*

One of the problems in the making of the Powers card and punching machine for the United States census was that of the 240 levers which formed an important part of each of the 300 machines which were illustrated on page 809.

In Fig. 1, the bars from *A* to *E* inclusive, represent the different stages of one of the outside bars having the extreme bend, while *F* and *G* are those used in the center of the group and require almost no bending or twisting.

The bars are first blanked out of cold-rolled stock as at *A* and afterward rounded at the upper end between dies in a crank press, while the lower end is notched, swaged down on the end to receive the celluloid key, having the small hole punched near the bottom and has a pin or projection forced out directly behind the notch. This projection is about one-half the thickness of the stock and is literally a punched hole in which the punching has only been forced half way through. These can be seen in detail in the different views.

The bars are now ready for the bending machines, one of which is shown in Figs. 2 and 3, which, though small and comparatively inexpensive, are particularly efficient as will be seen. Fig. 2

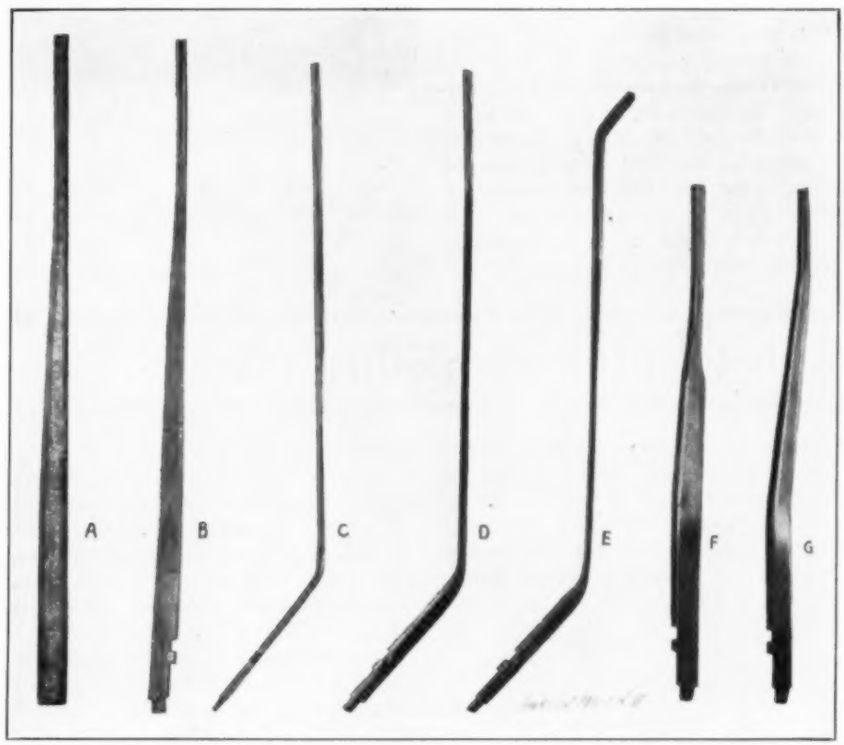



FIG. 1. SIX STAGES OF THE PUNCH BAR

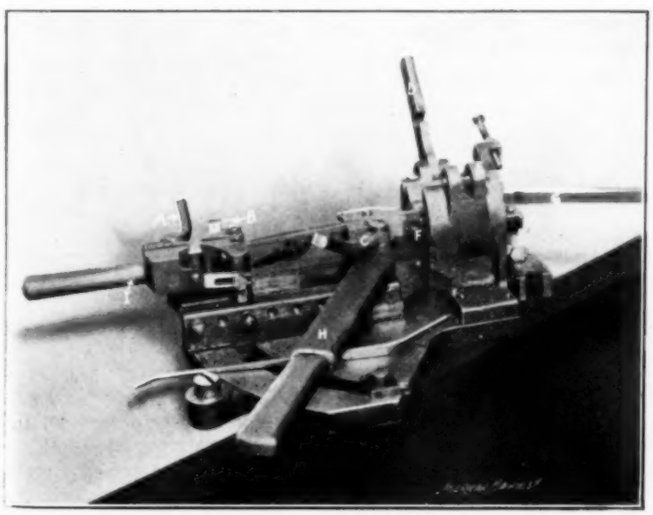


FIG. 2. BAR READY TO BEND

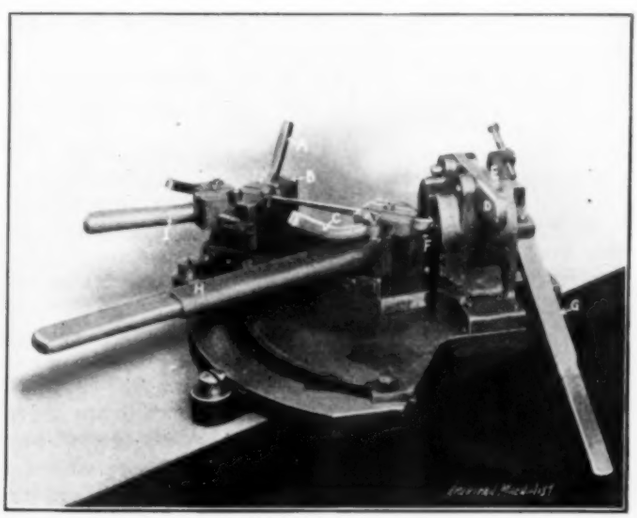


FIG. 3. BENDING THE BAR

shows the machine just after a straight bar has been placed in it and before the clamps *A*, *B* and *C* have been tightened on it.

After the bar has been placed the handle *D* is locked down over the pin *E*, clamping the broad end of the bar between the twisting jaws *F*. Then the handle *G* is swung to the left until its notch locks the end of the twisting jaws together and the desired twist is given by bringing this lever against the stop shown.

Then the first bend is given by the handle *H*, this swinging the whole clamping fixture in the arc shown until the desired bend has been obtained by bringing it against an adjustable stop which has been located in the proper place.

The next bend is obtained by swinging the handle *I* sidewise in either direction as may be necessary and this also operates against a stop which has to be adjusted for each key as with the others. The clamping handle *I* is also arranged so that it can be lifted and produce an upward bend if desired, although this feature was found to be unnecessary after the machine was designed.

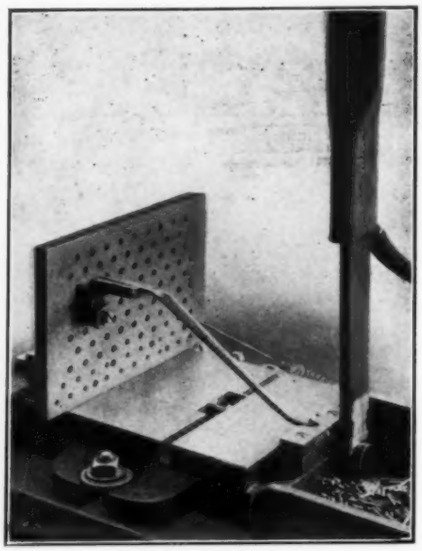


FIG. 4. SHEARING THE END OF BARS

Fig. 3 shows the fixture after the bar has been bent and before the clamps are released.

Fig. 4 is the device used for cutting off the ends of the useless bars after they have been bent, and although it appears crude in some respects it has proved particularly efficient and accurate.

The notched end of the bar is located in a groove in the small angle piece shown, its position being determined by a pin in the knot already referred to. This angle piece can be placed in 120 positions which represent one-half the entire keyboard of the card-punching machine, and after the bar is put in pace as shown, a single movement of the heavy shearing knife, clips the end of the bar squarely and evenly. The shearing knife is returned by the heavy coil spring shown, and the work was done easily and accurately with this device. It will be noticed that the slide in the center of the bed which supports the index plate, is adjustable with relation to the shearing knife so as to accommodate any variation in the length of bars. We are indebted to the Sloan & Chace Manufacturing Company, Newark, N. J., who made these machines, for these illustrations and the information in regard to the work.

# A Useful Multiple Slotting Fixture

*By J. P. Pedor*

The boss of the tool room when on one of his "sight seeing tours" around the shop, happened to see a machinist finishing a brass casting in a way that made him stop and look on. The casting was the dome of a locomotive pop safety valve, as shown in Fig. 1, and it had twelve slots cut at the top on varying angles. These slots were 3/32 inch, each one having an angle 5 degrees greater than the preceding one, except the last four which were cut on the same angle.

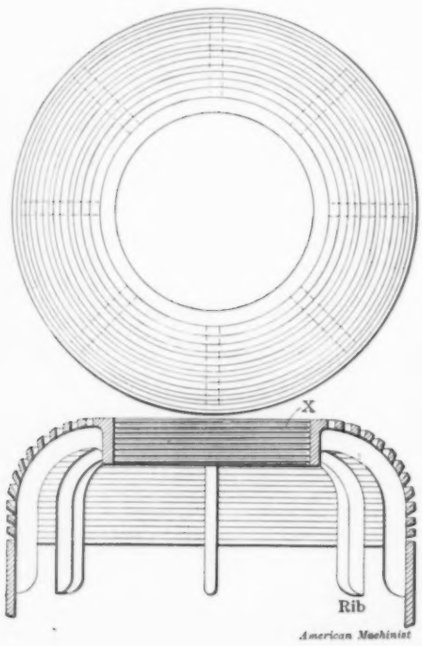



FIG. 1. THE DOME CASTING

In finishing this casting a man had to work with a cutting-off tool held in a compound rest, and after cutting one slot, would have to shift his tool around 5 degrees and cut the next. After watching him work one up, the boss went on, thinking to himself that a job like that ought to have a tool to cut all the slots at once.

After a few days thought the fixture shown in Fig. 2 was made. This cut the twelve slots at one setting and greatly reduced the cost of machining.

### DESCRIPTION OF FIXTURE AND HOW IT OPERATES

*A* is a cast-iron body with a shank *B* which is made to fit the turret on a monitor lathe; *C C C*, etc., are slots cut at the desired angle; *I* is a gear pinion; *D D D*, etc., are blades with teeth cut at angles corresponding to the slots. A blade is shown at *J* with the teeth. The slots are cut to depth of ½ inch and are held down by plate *E*. The lever *F*, which is shown in the top view, can be adjusted to any position by the split nut *G*.

To operate the tool the workman screws the casting on a nipple chuck, through the tapped hole *x*, Fig. 1. The chuck has a pilot sticking outside, about 1½ inches in length, that fits into hole *H* in the fixture, when this is brought close to the casting, and forms a steady bearing while the slots are being cut. By pulling over lever *F*, the teeth of pinion *I*, which are meshed with the blades *D*, bring them all forward, to cut simultaneously, and the backward swing of lever *F* brings the cutters out of the slots so the casting can be removed and another put in its place. The slots are cut in until they touch the supporting ribs on the inside.

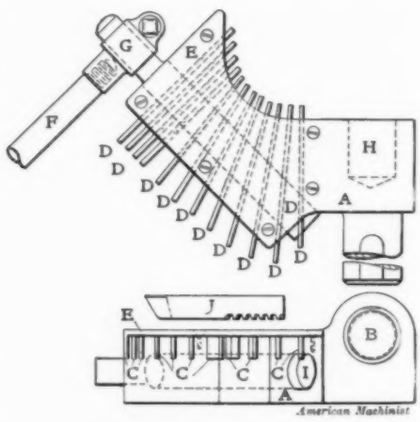



FIG. 2. TOOL FOR CUTTING SLOTS IN DOME OF SAFETY VALVE

# Machining a 21-inch Sluice Valve Body and Plug *By J. A. Gray*

The following method of performing the various operations in machining a sluice, or gate valve, body and plug, may be of interest to readers of the AMERICAN MACHINIST. It was adopted with success where a large quantity of these valves were handled, and I think will commend itself as expeditious and economical in labor cost. The times given are approximate and might be reduced. The greater part of the machining may be done on a good 18-inch center traversing lathe.

The first requirement will be a box fixture of not very elaborate design. This fixture, shown in Fig. 1, bolts onto the lathe saddle; first removing the slide rest and screw of same. It is faced on its base and also has a stout center pin on which it swivels. It really has a double base, as there is a separate parallel plate in addition to the box itself. This plate *B P*, Fig. 1, is permanently bolted to the lathe saddle, and has a central hole for the pin of the box to swivel, this hole being first set central with axis of the lathe.

The jig is now set in place upon the base plate, with the arms, marked *A A*, lying at right angles to, or true for boring with, the axis of lathe. It is clamped in this position to base plate and also located to same by means of a stout dowel. There are altogether five dowel pin holes in the base plate. Two positions are for the arms *A A* to be at right angles to the lathe bed, one being exactly opposite to the other. They are shown on the sketch, Fig. 1, as *a* and *b*. There is also a position for the arms to lie parallel with the lathe bed, for facing the cover flange and two other positions for the center of jig to incline, either side of the lathe centers, an exact number of degrees. This is necessary for truing the inside facings and recesses, to suit the required taper of plug.

Having located these five positions and drilled the dowel holes in base plate to suit, the jig is returned to its first position, *a*, and bored out in the two arms, *A A*, an easy fit to the body of valve marked *X*, Fig. 6. In these arms the valve body lies when being machined, clamped down securely by the cover plate *B*. By this means the body of valve is held true and with the thinnest parts of its walls free.

The jig, being now ready for use, the first operation is facing the branch flanges. This is done as shown in the general arrangement, Fig. 6, by means of a traversing arm, bolted to the faceplate, the feed being put on by a star wheel. If a traversing arm is not at hand, a good, stiff, slide rest will answer the same purpose; bolted to faceplate in the same way. In this case the turning tool will have to be cranked, as shown in sketch.

When one flange is faced in this way, the jig is unclamped, dowel pin removed and jig turned right around for the opposite flange. This brings dowel-pin hole in jig over hole marked *b*, in base plate. During these changes of jig positions the base plate is not moved; the jig merely swivels on it. The jig being doweled and clamped in this position, the second flange is faced. The next facing is the top or cover flange. For this the jig is set square to its first position, doweled, in *c* on base plate, clamped up and operated on in the same way as the other two flanges.

This now leaves the inside seatings or recesses to be done. These are operated upon, with multicutter face mills. Two are required; one for the iron body, and one for the brass facing. These cutters are not expensive tools to make. A cast-iron disk is slotted out on its face, to sizes given, and high-speed steel pieces are fitted in each slot. A steel wedge is then driven in at the back of each piece. These pieces are turned true when assembled in disk, then backed off and hardened. A cutter and wedge assembled in disk is shown in Fig. 5 which also shows formation of disk.

It will be noticed, in sketch of general arrangement, Fig. 6, that a bar is used for these two face mills. The bar is squared for a portion of its length, for the face mill to fit upon, and a collar, as shown, takes the thrust.

To place cutter on bar, the saddle of the lathe is run back, nearly clear of the bar, the cutter is then put into the throat of the valve and guided on to the squared part of bar, as you advance the saddle toward the head of the lathe.

The cutter in place, the next thing is to set the jig to one of its angular positions, either *d* or *e* in base plate, so as to bring the face that is to be recessed, parallel with the cutter face. This is located by the dowel, as before, jig clamped up and the saddle slowly advanced by hand till the required depth of recess is attained (a fixed mark on cutter disk will give this). Leaving the cutter in valve the saddle is drawn clear of bar and the jig turned around for the opposite inside recess. The same process is gone over as before and now the body of valve will be finished, preliminary to the facings being fitted; except drilling. By the above method, really five operations are done at one setting of valve in the fixture.

The time estimated for this machining including setting should not be more than three hours.

When the complete set has been ma-

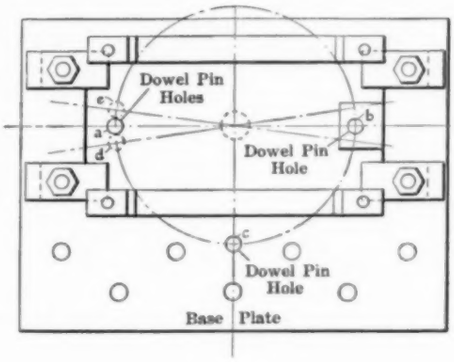



FIG. 1

FIG. 1. BOX JIG FOR VALVE BODY.

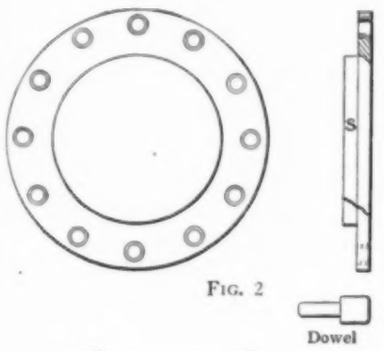
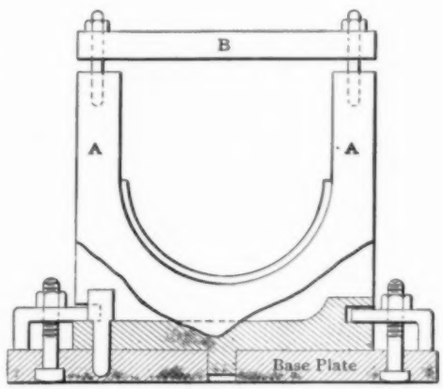



FIG. 2



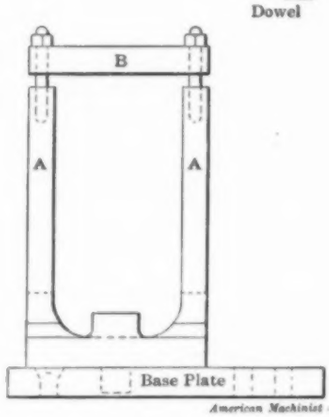




FIG. 2. FLANGE DRILLING JIG

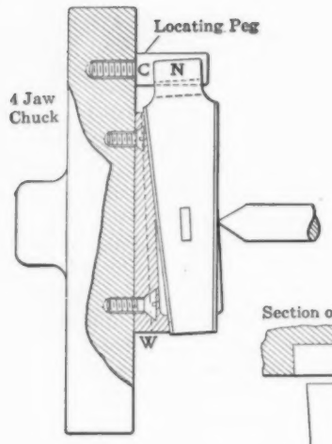
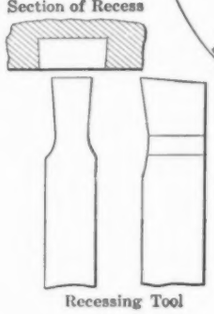
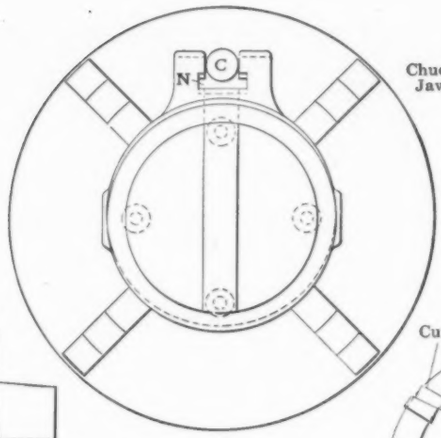



FIG. 3



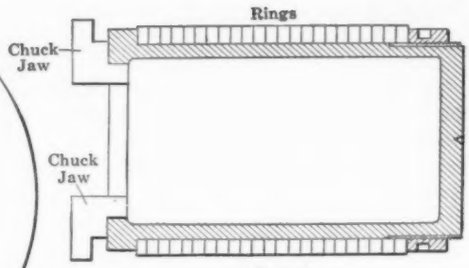




FIG. 4

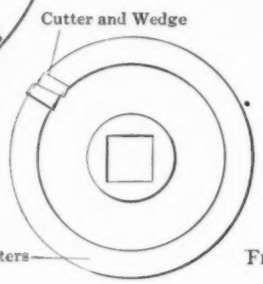



FIG. 5

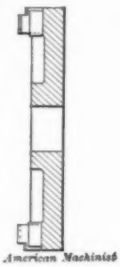


FIG. 3. WEDGE FIXTURE FOR PLUG

FIG. 4. MANDREL FOR RINGS

FIG. 5. FACING CUTTER

chined as above, the next operation will be the drilling of branch flanges. For this a plate jig should be used. A cast-iron flange is machined, as shown in Fig. 2; the spigot *S* turned an easy fit to the average bore of valve, that is, 12 inches diameter; holes pitched off to the number required, at given pitch circle diameter; then bushed with steel bushes, to sizes given. There need not be any exact tool making about this job and it pays for the making. The jig is located central on flanges, by means of the spigot *S* and when the first hole is drilled a dowel pin is set in through jig, and hole just drilled to prevent the jig turning while drilling the remaining holes.

The time taken on the two flanges should not be more than twenty minutes, assuming high-speed drills are used.

The cast-iron plug, is now ready to be faced and recessed. This operation can be done in an ordinary 18-inch, four-jaw concentric chuck. The only provision is to have a wedge piece the same taper as plug, so when the two are laid one on the other the two outside faces are parallel. This wedge piece, marked *W* in Fig. 3, is slightly smaller in diameter than the plug. It is set true on face of chuck and then setscrewed to same. A peg *C* screwed into face of chuck, engages with the nut recess marked *N* on plug and so locates the plug in the correct position on the wedge *W*. The jaws of chuck do not engage with this fixture in any way, but grip the plug only. A center is held up to plug, to keep it hard against the wedge. The turning is done with an ordinary front tool and a recessing cutter. In machining, it is as well to draw the recessing cutter to either side of recess, thereby producing a slightly dovetailed section to give a tighter bind on brass facing.

Time occupied in doing the two faces and fixing; 30 minutes.

There are now only the brass facings to machine. The best method is to hold them in a 4-jaw chuck by the outside diameter, on a capstan; have a tool bar in turret for boring at one cut and a facing tool in cross slide. Of course, there will be two different bore sizes; that of the plug facings being smaller. These, then, will be done in sets. When faced on one side only and bored, the facings should be mounted on a mandrel to suit the bore. There will be two mandrels required. This is shown in Fig. 4. They are then turned on their outside diameters for a press fit in recesses of valve body and plug. A ring gage should

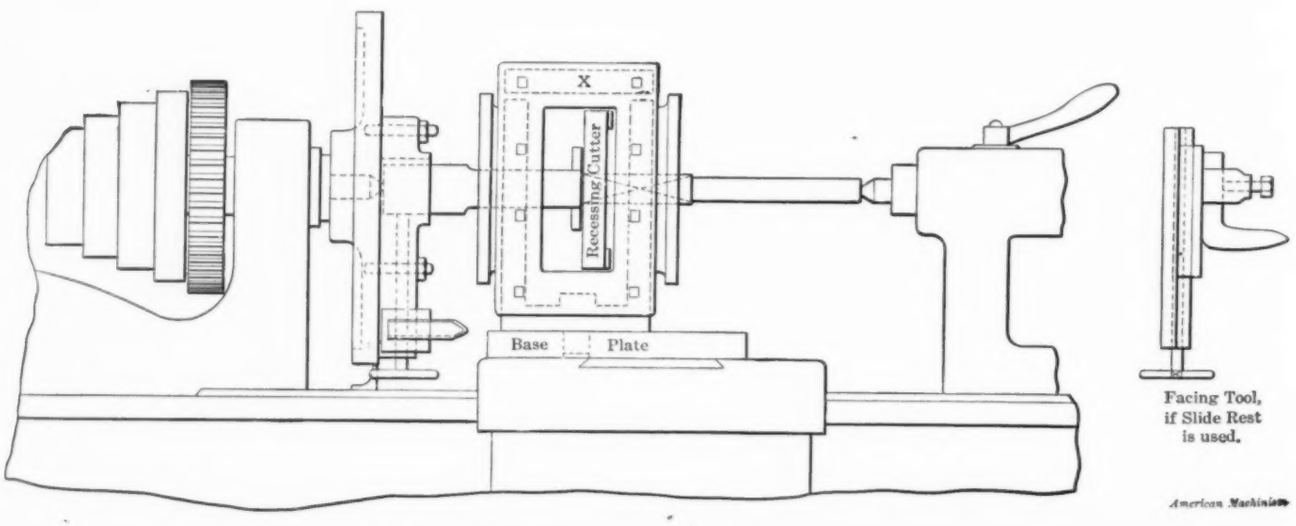



FIG. 6. GENERAL ARRANGEMENT OF VALVE BODY IN JIG

be used for sizing. These facings can be mounted, about twenty at a time, on their respective mandrels. About 10 minutes should be the time for each facing.

This leaves only one side of facing rough, which is machined in place, when pressed in valve body and plug. After being pressed in, in their respective recesses, with red lead to make a tight joint, the valve body is placed in box fixture, doweled in its angular position as before and the facing mill for brass, put on bar. Each facing is then carefully surfaced. This leaves a true surface and each valve body has its facings exactly the same taper. The plug facings, when pressed in, are faced on their same taper wedge in the 4-jaw chuck.

When the plug is assembled to its valve body, it will be very little short of a water-tight joint; only a touch with a scraper on a high point here and there being required to let it right up close and tight.

Time required for pressing in facings, setting in fixtures, facing and finishing, for test on valve body and plug; 4 hours. This makes a total time, for all operations on one valve body and plug, of 8 hours.

# Proposed Patent Office Building

*By Irving D. Kimball*

The crowded conditions in the present United States Patent Office have been a source of great delay and disproportionately increased expense during a number of years. Commissioner after commissioner has struggled with the problem of finding room for the examining force, the increasing printed copies of patents, the old models, etc.

The present building was started in 1836, what is now the south front of the building being erected. This was completed in 1840 at a cost of $422,000. In 1849 the east wing was begun and completed in 1852 at an outlay of $600,000. Plans were then drawn for the completion of the building as it now stands. The west wing was finished in 1856 and cost $750,000, and the north wing was completed in 1867 at a cost of $755,000. The building, when completed, totaled $2,347,000.

For many years it has gradually been necessary to crowd out the old models, to turn storage space into examining rooms, and to use every nook and corner, such as under stairways and halls and corridors, for the storage of printed copies of patents. The examining rooms have had the desks crowded more and more closely together, thus greatly interfering with business, while the necessity for filing printed copies of patents all over the whole building has greatly increased the cost of filling orders for such copies.

As far back as 1899, Commissioner Duell called attention in his annual report to the crowded condition of the building, and urged the passage of a bill then before Congress, providing for a new fireproof building. The removing of the Land Office from the patent building gave slight temporary relief. At about this time some of the models were removed and stored in a rented building.

During the summer of 1903, Commissioner Allen, while in Germany, noted the plans for greatly increased patent-office facilities for that country. Land had been purchased and buildings planned for a force of 2000 employees. The Germans have been the first European country to adopt our plan of preliminary examination and now bid fair to surpass us in the facilities for carrying it on.

In 1904, about 25,000 models were removed from the galleries and stored in a rented building, the space obtained being used for the storage of printed copies of patents and other records.

When the present commissioner came into office in 1907, some additional room was supplied through the efforts of Secretary Garfield. The commissioner, in his report for 1907, made extensive recommendations to provide more room. These included lowering the grounds around the building to permit use of all of the basement floor, the changing of the model hall into two stories by introducing an additional floor, and the building of granolithic sidewalks around the entire building, space to be provided underneath the sidewalks for the storage of printed copies of patents. If these changes were not deemed desirable, he strongly urged the building of a modern fireproof structure from the surplus to the credit of the Patent Office in the Treasury.

During 1908 23 additional rooms were made available for the use of the office, the force was increased, and the salaries of the examiners also. Commissioner Moore again urged the necessity for a new building and called attention to the fact that Great Britain and Germany had each just completed new buildings for their patent offices which were more commodious and better adapted for business than the patent building in this country, although the yearly business of those countries was far less than that of the United States. These same arguments were repeated in his report for 1909 and the passage of Senate Bill 1629, providing for a new building, was recommended and urged.

It should be borne in mind that several years would be necessary before a new building provided for now could be ready for occupancy. The condemning and tearing down of present buildings, the submitting of competitive designs and selection of the one thought most desirable, as well as the construction of the building, will all require time during which the present conditions will be replaced by an even more crowded state of affairs.

Senate Bill No. 1629, mentioned above, provides for the purchase of a site and erection of a building for the use of the Patent Office upon three plots of land and inclosed streets just east of the Capitol. This building would be of fireproof construction and of an architecture corresponding with the Congressional Library building. The bill provides for the expenditure of $600,000 for the purchase of the site and for removing the present buildings, and $5,000,000 for the erection of the building.

The preparation of the site and erection of the building is placed in the hands of a commission consisting of the Secretary of the Interior, the Commissioner of Patents, the First Assistant Secretary of the Interior, the superintendent of the building of the Library of Congress, and the architect of the Capitol. It is proposed that the building shall contain a hall of inventions where old models can be displayed in such a way that their evolution and development will be effectively shown. A prize of $5000 is provided for the architectural design accepted.

Practically all the other departments of the Government are run at a loss in order that the public can be served at a low cost. Not so with the Patent Office. The inventor has to pay for all he gets and a surplus beside. In this way there has accumulated in the United States Treasury a fund of $7,000,000, which shows the net earnings of the Patent Office.

For ten years the Commissioners of Patents have been urging the necessity for more room to economically carry on the work of the office, and during this 10 years the business of the office has increased about 50 per cent.

Anyone connected with a manufacturing concern knows that the plant has a capacity for about so many men and machines and so much material. If, in an endeavor to increase production, more men, machinery and materials are added, economic losses result. Many of the delays that inventors and applicants have to contend with in the Patent Office are due to the overcrowded conditions of the present inadequate building, and for this reason alone the passage of Senate Bill 1629 should be assured.

# Applications of the Mechanical Woodworker in Pattern Shop

## *Easy Adjustment and Wide Range of Work Its Main Features*

By Robert Reid *

The Wadkin Mechanical Woodworker is an English invention that is particularly adapted to the irregular work of pattern making, and as it is very easy of adjustment, it lends itself conveniently to the varying demands of pattern work; repetition work being the exception, rather than the rule, as it is very seldom that two jobs come exactly alike.

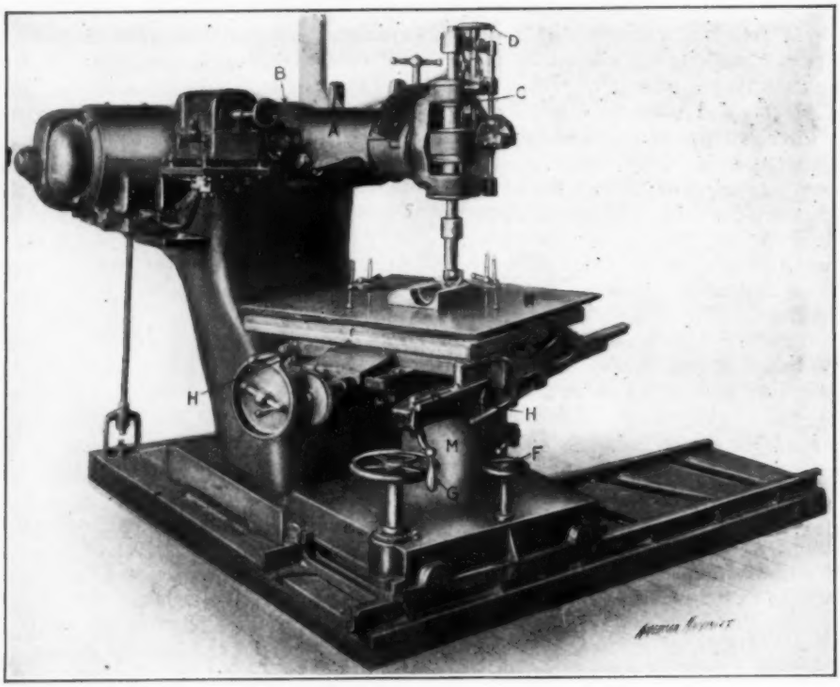



FIG. 1. UNIVERSAL WOODWORKER IN PATTERN SHOP OF GENERAL ELECTRIC COMPANY'S SCHENECTADY PLANT

The conditions are very well illustrated in the photographs shown. The great flexibility of the machine makes it possible to do almost any conceivable job of pattern making at a great saving of time, and this at a great saving in cost. It is very easily set up for any work which may come to hand; curved work up to 8 feet in diameter, and any angle can be finished. For these reasons the machine herewith shown was installed in the pattern shop of the General Electric Company's Schenectady plant.

It has a great number of adjustments; the arm *A* in Fig. 1, which carries the spindle head, is balanced by means of a counterweight *B*. It is capable of about 30 degrees adjustment downward from the horizontal, as shown in Fig. 3, and can be securely locked in any position. The cutter spindle on the end of the arm, is driven by a quarter-turn belt through the arm *A*, which is hollow. The spindle head is capable of swinging through an angle of 90 degrees in either direction, from the vertical position, as shown in Figs. 2 and 3. It has a lateral hand adjustment by means of lever *C*; also a fine feed by the screw *D*.

### MOVEMENTS OF TABLE

The table is mounted upon a square base that can be moved horizontally along the rails, by means of handwheel *E*, and locked in position by wheel *F*. The table may be raised or lowered by means of crank *G*, and has a longitudinal movement along the rails *H*, on ball bearings and likewise a cross movement, as best seen in Fig. 2. Both movements are made by means of crank *K* and wheel *L* which is duplicated on the opposite side of the machine. It is also capable of being swung through a complete circle on the pedestal *M*. In addition to the above movements, the upper plate *N*, which is pivoted on a central pin, may be turned at will, by means of a removable hand lever that is fastened to the top of plate *N* by a thumb screw.

### ELBOWS, STAVES, ETC.

This being intended for patterns of a circular nature, such as elbows or curved work, and their core boxes, it will thus be seen that the table can be raised, lowered, turned horizontally through a complete circle, moved lengthways, crossways, or at any angle that may be required.

In Fig. 4 is shown a core box for a pipe elbow that is clamped to table while being cut by means of a fly cutter. In this class of work the piece is clamped to the upper plate; the table set by means

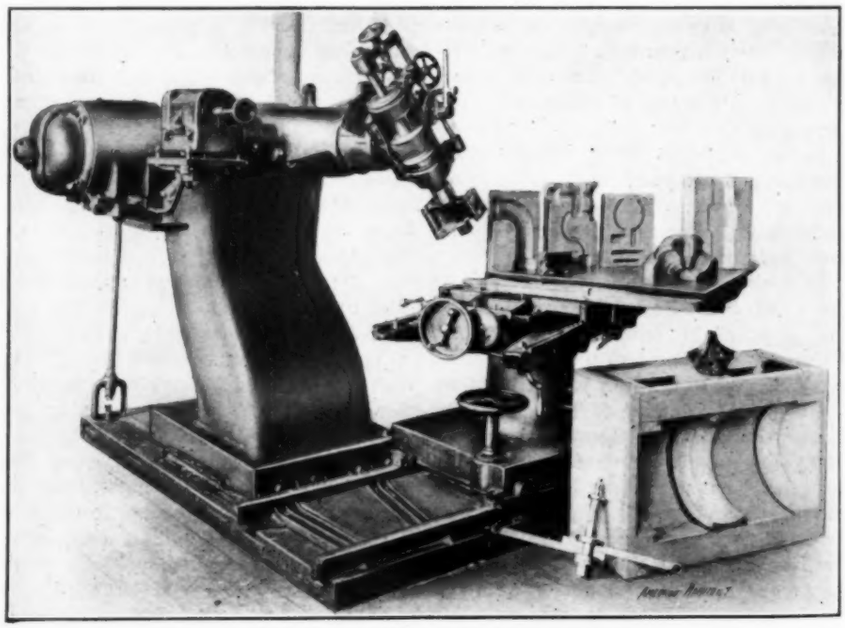


FIG. 2. WOODWORKER WITH CUTTER HEAD SWUNG AT AN ANGLE AND SOME WORK

*Assistant mechanical superintendent, General Electric Company.

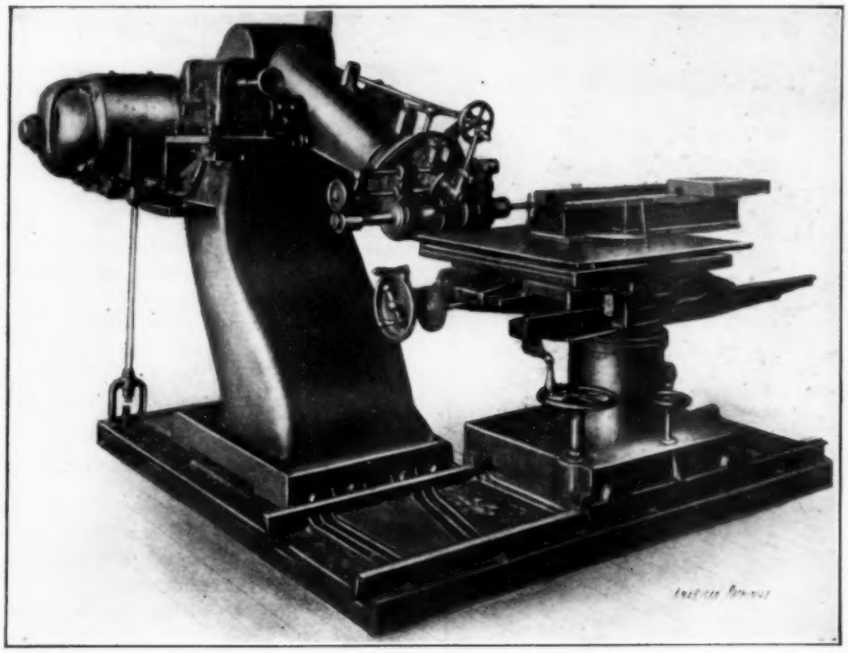


FIG. 3. WOODWORKER WITH ARM INCLINED AND CUTTER AT 60 DEGREES

of the crank *K* and wheel *L*, to give the required radius, and the cutter lowered by lever *C* or screw *D* to the proper depth. The work is rotated through an angle of 90 degrees, by swinging plate *N* with the hand lever, or by swinging the whole on the pedestal *M*. The straight part of the work is performed by moving crank *K* and wheel *L*.

Some of the different kinds of work that have been made on this machine, likewise some of the cutters that are used, may be seen in Fig. 2. The smaller core boxes were shaped out by means of fly cutters of the proper radius, as in Fig. 1. While the large box on the floor was machined out with the type of cutter leaning against its left-hand end. The cutter on top of the large core box is used for making pipe bends, as shown in Fig. 4.

The shaping of staves for circular work, such as large pipes, electric motors, and cylindrical work of any kind, is shown in Fig. 5. In these the curved top and beveled sides are cut at the same time. When cutting the cutters take the positions shown in the upper left-hand corner.

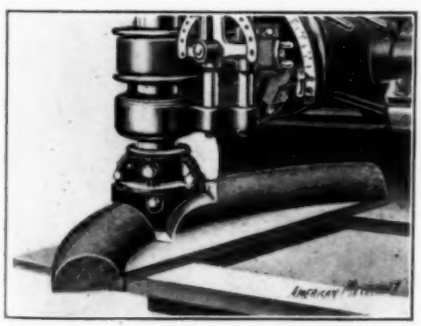


FIG. 4. MAKING PIPE BENDS

### CORE-BOX WORK

The machine is very useful for core-box work of various kinds, and a big saving in time is effected by machining parts that enter into the construction of core boxes, which are similar to those shown in Fig. 6. These can be made in any segmental part of a circle that is desired, and when they leave the machine it is only necessary to sandpaper and varnish them.

The possibilities of the machine are shown in the irregular shaped core box in Fig. 7. On this box the fillet *O*, which was of a large radius, the half circle *S* and the half round hub *U* were cut on this machine. On the fillet *O* the box was deeper at *P* than at *R*, and the box was inclined enough to make this cut. The fillet was also partly cut on a radius and partly on a straight, and this was all done with one cut or one setting of the machine. The half circle *S* blended into the flat place in the bottom of the box and this part of the work was done on the machine. The hub *U* was also entirely cut on the machine, notwithstanding the fact that the box was deeper at *P* than at *R;* the machine taking care of the change of section, due to the different depths. From the 10-foot pole beside the box one can get an idea of its size.

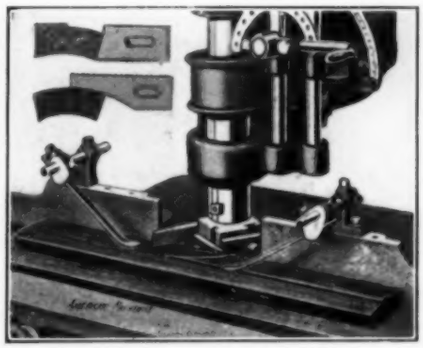


FIG. 5. CUTTING STAVES

### GEAR WORK

The machine is also well adapted for other kinds of work, such as dovetailing, tenoning, panel work, moldings of different kinds, stair railings, etc. It is particularly adapted for the cutting of gear teeth of various kinds, such as involute, bevel, helical, worm gear and

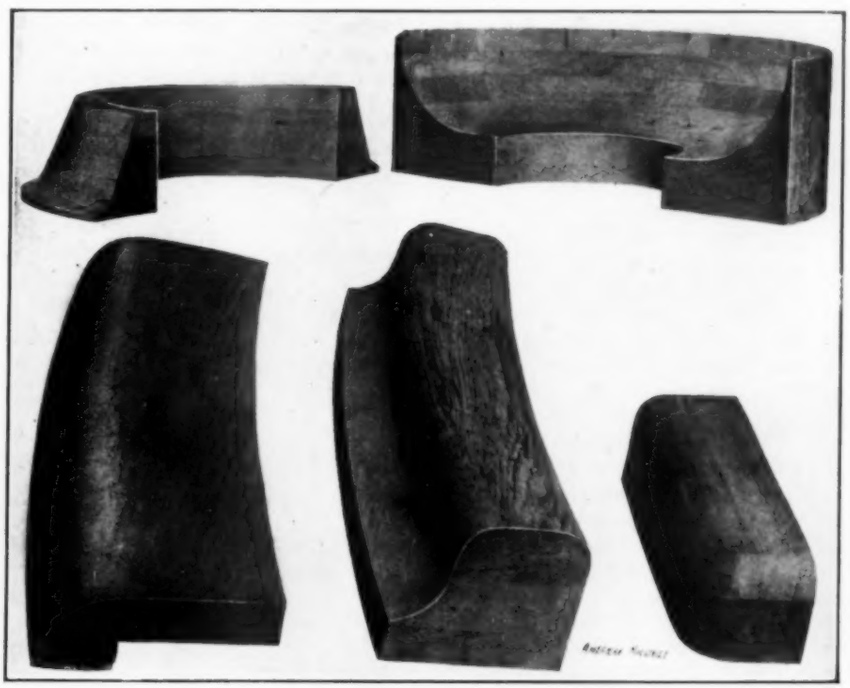


FIG. 6. PARTS OF LARGE CORE BOXES MADE ON THE MACHINE

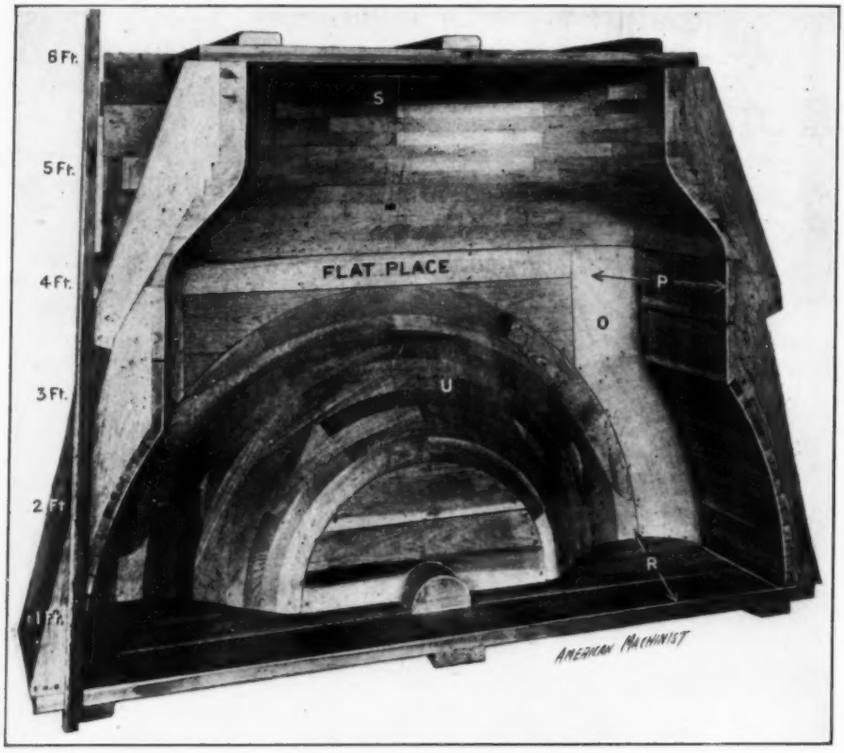



FIG. 7. ONE OF THE DIFFICULT CORES MADE ON THE MACHINE

worms, etc. For this kind of work the pattern is usually built up as a blank; care being used to have the grain of the wood run in the proper direction for the teeth, the pattern is then mounted on the machine, and the piece cut by a fly cutter that is the exact shape of the space between the teeth. Gears can be cut in a few hours that it would take days to do by other means, and when they leave the machine it is only necessary to sandpaper them.

Other kinds of work, too numerous to mention, can be done on this machine; a great deal depending upon the ingenuity of the workman in charge, as with a little thought and planning, he may be of great assistance to the other workmen to whom the piece may go for the finishing touches. A suction pipe is shown, by means of which all shavings are removed.

The machine is driven by a 3-horsepower variable-speed motor of the General Electric type, this securing a great range of speeds. The Oliver Machinery Company has the American agency for this woodworker.

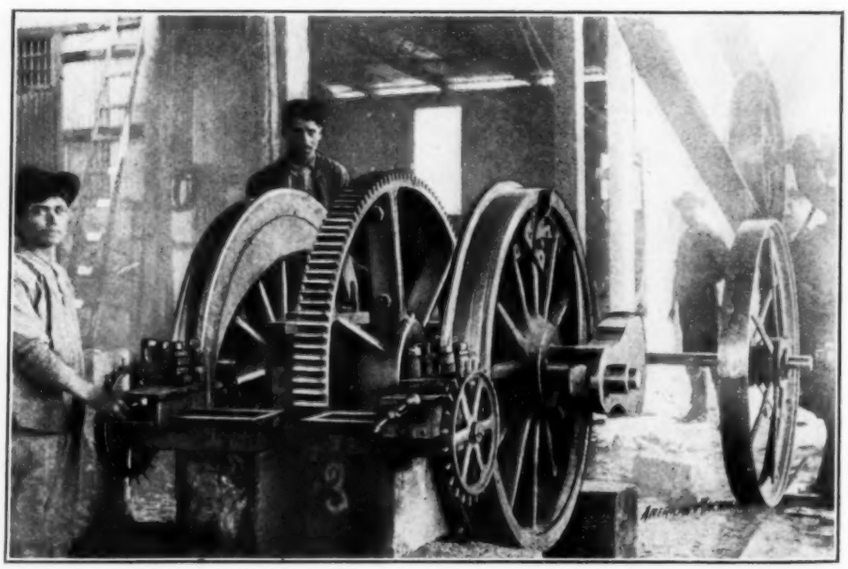
An Englishman has invented a new explosive shell which, it is reported, will very possibly replace dynamite on the Panama Canal work. It can be hammered with a sledge, shot into with a rifle or burned without being set off. In official tests ordinary dynamite detonators were exploded in it both by fuse and by electricity, but it would not explode. But when the special detonator set it off, it proved more powerful than dynamite. Those interested say that it is one-half more powerful than the 66-per cent. grade of dynamite, and that the cost of manufacturing will be more than $20 a ton cheaper. The inventor hopes to get the contract to furnish all the explosives to be used next year.

# Railroad Shop Equipment in Mexico *Editorial Correspondence*

In the line of railroad-shop equipment, the driving-wheel lathe illustrated in the accompanying halftone will be of interest mainly because it is difficult to imagine that such a machine would ever turn out any work at all. This lathe is in use in the shop of a branch railroad in Mexico, and it is said that it is able to turn out a pair of drivers in one week. Compared to modern machinery, this output bears a ratio of about 1 to 50.

As will be noted, a large portion of this machine is made of heavy square timbers. The axle of the drivers turns on its own journals in bearings which are bolted to the two cross timbers. The modern idea of center drive is carried out. The main driving gear is in halves and is clamped over the axle, a moderate degree of alinement being secured by means of wedges between the shaft and the hole in the hub. Meshing with this main gear, is a pinion on the shaft at the rear, carrying the driving pulley, which is seen to overhang its bearing by at least 4 feet. The tools are carried in cast-iron slide rests, these in turn being bolted to the wooden timbers. The question of alinement would appear from this to be a not very serious matter.

Even on this primitive machine the feed is automatic, as is evidenced by the two-star wheels beside the tool holders. It is through the courtesy of the Niles-Bement-Pond Company, of New York City, that we are enabled to publish this curious illustration.



CENTER DRIVE WHEEL LATHE IN MEXICO

# Subpress Tools for an Aluminum Blank

*By A. M. Cahill*

The accompanying sketches show a sectional subpress die with a stripper operated by a spring inside the ram of the subpress. The blank, Fig. 1, is of aluminum stock 0.018 inch in thickness. The die and stripper, Fig. 2, are precisely alike and are built up in 8 sections, with holders, Figs. 3 and 4. The guide for the stripper holder is shown in Fig. 5. The punch-clamping sections, Fig. 6, are also eight in number. The punch blades and core punch, the punch holder and the assembled punch are shown by Figs. 7, 8 and 9. The die holder, Fig. 4, is of tool steel, 2½ inches in diameter, by ⅝ inch thick, and the outside is turned on a one-degree taper to enter the seat in the base of the subpress with a drive fit. The stripper holder, Fig. 3, is also of tool steel. The periphery has two steps, the larger of which is 2 inches in diameter, the smaller one-eighth of an inch less. It is made a sliding fit in the guide ring, Fig. 5, so as to be operated by pins from the spring inside the ram. The sections for clamping the punch blades and core punch are of tool steel, and their form is shown in Fig. 6.

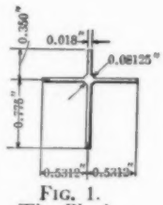


FIG. 1. The Blank

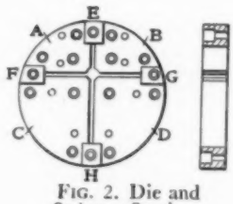


FIG. 2. Die and Stripper Sections

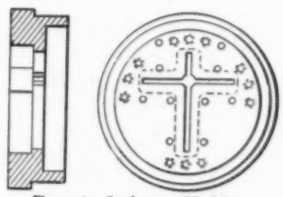


FIG. 3. Stripper Holder

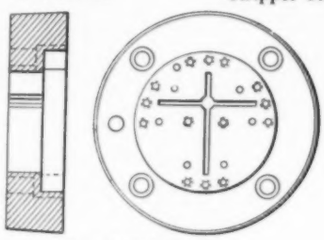


FIG. 4. Die Holder

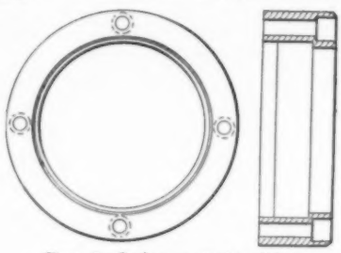


FIG. 5. Stripper Guide Ring

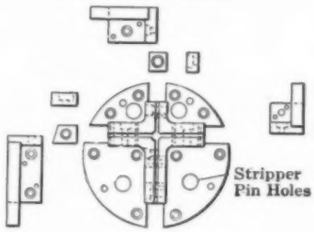


FIG. 6. Punch Sections

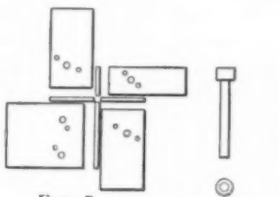
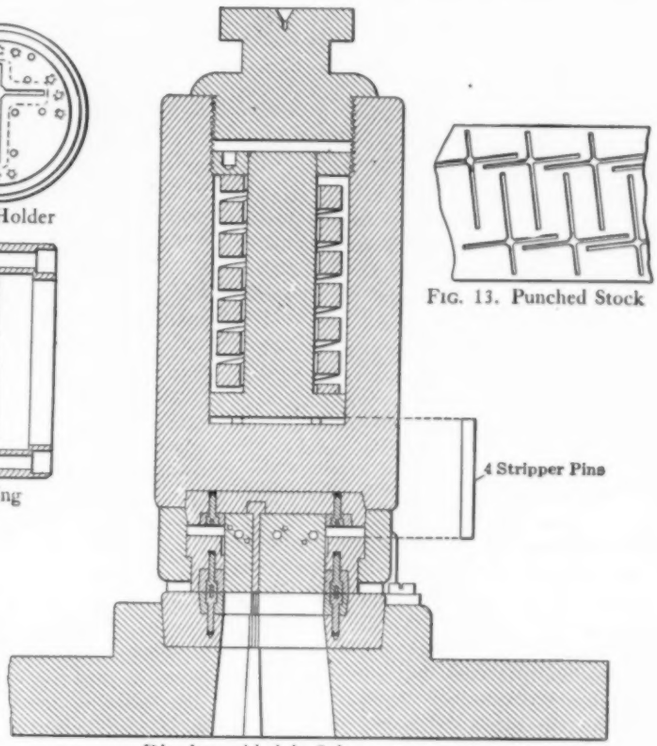


FIG. 7. Punch Blades


Core Punch



Die Assembled in Subpress


FIG. 13. Punched Stock

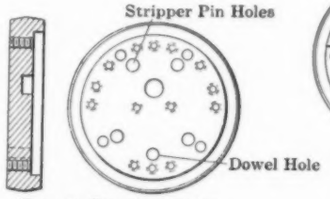


FIG. 8. Punch Holder

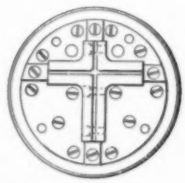


FIG. 9. Assembled Punch

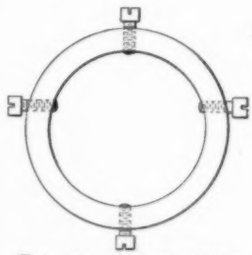


FIG. 10. Clamping Ring

FIG. 11.

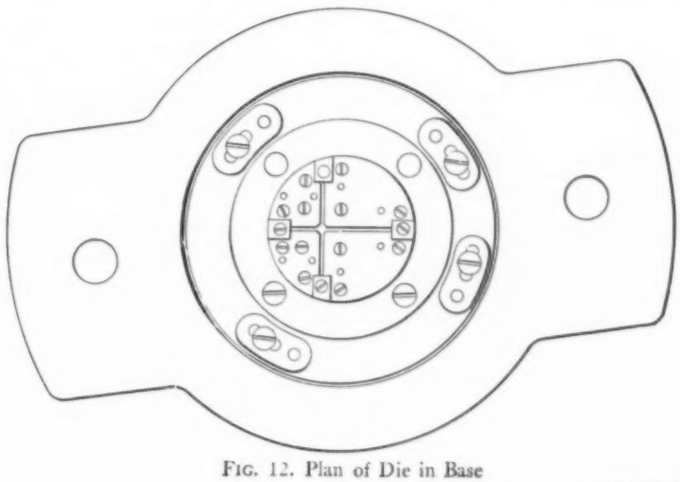


FIG. 12. Plan of Die in Base

American Machinist

SUBPRESS TOOLS FOR AN ALUMINUM BLANK

FIRST OPERATION ON THE BLANKS

The first step in making these tools was to procure three tool-steel blanks 1¼ inches in diameter, two of which were 11/32 thick and the third ⅜ inch. The

blanks were mounted on three separate solder chucks so that all three pieces might be carried along together, and were turned down on the outside, allowance being made for grinding to the diameter of the seat. Then the long blank, or the blank that was intended for the punch was placed in the dividing head of the milling machine and milled on 4 quarters so that a wall of about one-tenth of an inch was left around the seat for the blades and the central punch, leaving the round flanged bottom about one-eighth inch thick, as in the illustration, Fig. 6. Then, with a saw 0.01 inch thick a cut was made to a depth of about 0.15 inch across the blank, the dividing head turned one-quarter turn, the cross slide of the milling machine adjusted to the relative position of the short arm on the blank, Fig. 1, and another cut made the same depth as the first. The partly finished blank was removed from the dividing head and replaced with one of the shorter blanks, and operations carried on in like manner with both die and stripper sections, but instead of sawing 0.15 inch deep I just sank the saw in this case to one-third the thickness of the blanks.

### Duplicating the Slots on the Opposite Face

All three pieces were now removed from the solder chucks. One chuck was placed in the dividing head after cleaning up the face in the lathe and with the same 0.01-inch saw a cut was made diametrically across the brass chuck, the dividing head turned 90 degrees and a second cut made the same as the first. Parallel pieces 0.01 inch thick were inserted in these slots and allowed to protrude sufficiently to engage with the slots in the steel blanks when these were placed in an inverted position. The 0.01-inch slots were then cut to one-third the depth on the other face of the die and shedder blanks and about 0.15 deep on the opposite side of the punch section blank. All slots were bound to come exactly opposite each other without adjustment of the cross slide of the milling machine. The 0.01-inch saw was then removed and replaced with a saw ⅛ inch thick and the stock cut away at the four ends of the slots, allowing about 0.005 inch for grinding all around. To insure this cut being central with the 0.01-inch slots, a cut was made all on one side of the center of the slot, the blanks turned over and the cut taken on the opposite side without moving the cross slide of the milling machine. In this way the cut was equal on both sides of the 0.01 slot, thus insuring accurate openings to receive the end pieces *E*, *F*, *G* and *H*. I proceeded in like manner with all three pieces and had no difficulty in making everything come out correctly.

### Boring, Hardening and Grinding

After this milling operation was finished, the three blanks were placed successively on the same solder chuck in the bench lathe and a hole bored (allowing 0.005) where the slots crossed each other for the central or core punch, then all screw and dowel holes were drilled and screw holes tapped in all three blanks including screw and dowel holes in the punch sections for securing the blades. The three pieces were pack hardened and the temper drawn until solder would melt on them.

The next operation was grinding. The three pieces were ground on their faces on the surface grinder, then soldered each in turn to the chuck last used and with a diamond lap ground the four openings to receive the end pieces *E*, *F*, *G* and *H*, which also acted as distance pieces in all three cases.

After this I made up the four end pieces *E*, *F*, *G* and *H* for each blank, hardened and ground them to fit their respective openings, clamped them in position and with the clamping ring, Fig. 10, soldered them on the face and also to the solder chuck and ground the periphery of each to fit its seat with a snug fit on a 2-degree taper. I then broke the sections *A C* from *B D*, leaving *A* tied to *C* and *B* to *D*, clamped them to a square block and ground the broken or rough walls so they were in the same plane as the sides of the openings previously ground with the diamond lap, using the openings at the end of the short arms as gage points to measure by. Section *A* was then broken from *C*, and *B* from *D*, and the walls where broken apart were ground absolutely square with the previously ground walls; the ends of the openings being used here also for measuring points. The two other parts were treated in like manner, and both die and stripper sections pushed into their seats in their holders. Then we transferred both screw and dowel holes, fastened the parts securely in their seats with screws and pins, ground both faces and not the slightest evidence of a joint was visible.

### Making Punch Blades

After the die and stripper were completed and the sections finished also for the punch, work was started on the blades.

A piece of sheet steel 0.025 inch thick was procured and two pieces cut off, one of which exceeded the length of the short arms from tip to tip, while the other was longer than the upright arm of the cross from tip to tip. The width of these pieces was a little over seven-eighths of an inch. In the short piece of steel a central cut was made about half way from edge to edge, and in the long piece a similar cut was made at the point where the arms cross each other in the blank, Fig. 1, then one blade was slipped over the other at the point where the cuts were made, the sections clamped around them in their respective positions and dowel and screw holes drilled for clamping the blades in position.

I then released the blades, hardened them between plates, drew them to a straw, ground and lapped them on both sides. Then I broke them apart at the point where the cuts were made, rough ground them square so as to allow the screw and dowel holes to line up, as in grinding the thickness of the blades brought the sections closer together, thus necessitating bringing the holes in the blades together, also into correct relative position. The blades were clamped in position with screws and the dowel holes lapped so that hardened, ground and lapped pins could be pushed into the holes. Then I faced off the backs of the sections and face of the blades on the surface grinder. After this the outside edge of all four blades were ground to the figures on the blank, Fig. 1, the screws and dowels removed and the inner ends of the blades ground, allowing about 0.002 inch on each to be ground out circular to conform to the radius of the core punch which is 0.07125 inch in diameter. Four end pieces like *E*, *F*, *G* and *H* were then clamped and soldered in position.

At this point the punch was completed with the exception of grinding the periphery and the hole to receive the core punch, in Fig. 7, which was done when the corresponding holes in the die and stripper were ground. The next move was to line up all peripheries and also the previously mentioned holes for the core or central punch.

### Lining Up the Work on the Face Plate

To do this it was necessary to swing the die in the holder on the face plate of the lathe so that the axis of both arms was dead true with the spindle of the lathe. I made the button, Fig. 11, slipped it over parallel pieces which were inserted into slots in the die, trued up this button on the face plate by means of an indicator and clamped the work securely. I then released the button and parallel pieces, slipped the stripper over the punch blades, entered the blades into the die and waxed them in this position, then counterbalanced the job with a lead weight. Then I ground the center hole, which was walled up with the four quarter sections of the die stripper, and punch and with the edges of the punch blades, to 0.08125 in diameter and on looking through this hole after it was lapped with very fine diamond dust on a plug lap it was found to be one continuous internal surface without the slightest evidence of a seam, notwithstanding that the surface was formed with sixteen separate pieces. The alinement was completed by grinding both steps on the stripper holder, to a sliding fit in the guide ring, Fig. 5, also grinding the outside of the punch sections to fit the holder with a snug fit on a

1-degree taper. The parts were next removed from the face plate, the core punch in Fig. 7 pushed into the hole in the punch and the assembled punch placed in the holder and fastened securely with screw and dowels.

THE COMPLETED TOOLS

When I arrived at this point the die was completed with the exception of the routine work of fitting up the base and the body and making a receptacle in the base and plunger for the punch and die holders, screws, dowels and springs. This was finished in a few days and the entire job assembled as indicated in Fig 12. I tried the punch for alinement and found it entered without the least particle of resistance. A few blanks were turned over to the inspector and the biggest variation was two-tenths of a thousandth. Fig. 13 shows the manner in which the blanks were punched from the stock with as little a waste of material as possible.

# Transmission of Power by Belts*

*By Reginald Krall*

In Germany and Belgium a recent development in power transmission is the use of belts made of thin steel. These belts are made from 0.008 to about 0.035 inch in thickness, and from about 0.087 to approximately 8 inches in width.

A trouble which was at first encountered was the liability of the belts to break, due to unevenness in the quality of the steel. This is being rapidly overcome by the use of a specially manufactured steel of high temper. The construction of a suitable joint was another matter which at first occasioned difficulty. An ideal drive would naturally be obtained by the employment of a continuous steel band, but there are many difficulties in the way of producing such

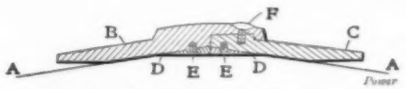



FIG. 1. JOINT FOR STEEL BELTS

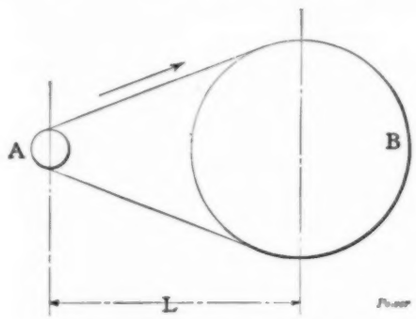



FIG. 2. ORDINARY BELT DRIVE

a belt, and its cost would probably be prohibitive.

Originally, the joint was made in such a way that the belt had to be soldered while in place on the pulley, but this method has been improved upon. With the joint in present use, which is shown in Fig. 1, the necessary soldering is done at the belt factory by trained men; the user has only to put the belt in position and insert a few screws. This is very important because it is necessary, in order to preserve the temper of the steel belt, that the solder shall be of a low melting point, not exceeding 390 degrees Fahrenheit. In Fig. 1, *A* is the steel driving belt, *B* and *C* are the two halves of the lock, *D D* are two small triangular filling pieces, *E E* are two rows of small screws, securing these triangular pieces to the belt and the locking pieces *B* and *C*; *F* is one row of large screws uniting the locking pieces. All that has to be done to fix the belt in position is to insert the screws *F* which have already been prepared by the manufacturer. It will be noted that the ends of the locking pieces *B* and *C* are prolonged. It was discovered that when these extensions were not provided, the belt would break near the small triangular pieces *E D* just after leaving the pulley, probably owing to the rapid straightening of the belt after its rapid motion over the pulley.

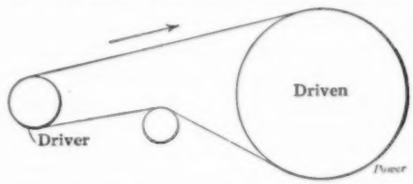



FIG. 3. USUAL LOCATION OF JOCKEY PULLEY

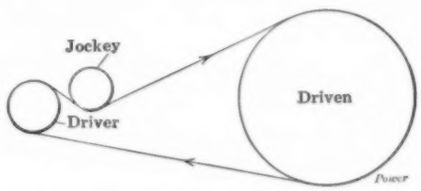



FIG. 4. IMPROVEMENTS IN LOCATION OF JOCKEY PULLEY

A curve is given to the under surface of the joint.

For the determination of the length of the belt, a special apparatus has to be used, by which a light tape of steel is drawn over the pulleys and subjected to a predetermined tension, the two ends being drawn up together and caused to overlap; both ends are then cut through at the same point and a band the exact length of the belt required is thus obtained.

These steel bands run quite well on bare pulleys, but after a time there is a tendency to polish the surface of the pulley, and it is therefore desirable to cover the pulley with a very thin cork covering, which is glued onto canvas and in turn cemented to the pulley. In properly designed drives there is absolutely no slip, that is, no slip that can be detected. In practice, this is proved by the fact that the cork covering does not wear away.

Belts of steel appear to offer some considerable advantages over those of other materials. They do not stretch, and therefore never have to be taken up. For the same reason, no tension is required for allowance for stretch. As compared with ordinary practice, very much narrower belts can be employed, varying in width between ⅓ and 1/10 of that of an ordinary belt, which saves very much in cost of installation. Very high speeds, up to 10,000 feet per minute, may be employed. The belts do not appear to wear. The pull on the bearings and the wear thereof are reduced. Short drives may be used.

On the other hand, the material may not prove to be sufficiently reliable, but,

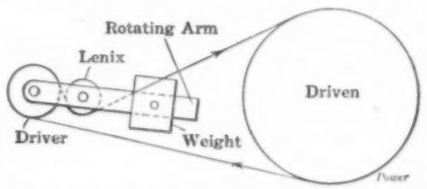



FIG. 5. ARRANGEMENT OF PULLEYS WITH LENIX SYSTEM

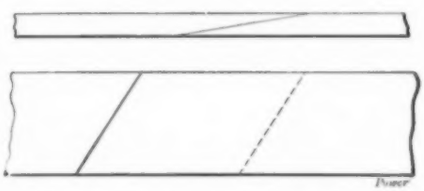



FIG. 6. A LEATHER BELT JOINT

as already pointed out, its unreliability is speedily being remedied. Another point is, that unless properly guarded, steel belts might prove to be very dangerous if they broke when running at high speed. The necessity of having to be careful about the exact length may also prove troublesome. These belts must be extremely well applied to insure the power being evenly distributed over the width of the band and to avoid any tendency to split the band.

Although this method of driving by steel belts is too new to have fully established its claim to general adoption, some thousands are already in use, and there can be do doubt but that the system will be regarded as of very great importance in the future.

THE LENIX SYSTEM

Another form of belt driving, in which

*Abstract of paper presented before the Junior Institution of Engineers.

belts in common use are employed, is the invention of Captain Leneveu, a French artillery officer, and is known as the Lenix system.

It is generally agreed that short drives by belts, vertical drives or large speed ratios should be avoided. Captain Leneveu, however, has demonstrated that with his Lenix system, the closer the two pulleys are together, the better the drive; that vertical drives may be made as efficient as drives in any other direction, and that his system possesses many other advantages.

The Lenix system has met with much opposition, which is largely due to the fact that what might be described as a jockey pulley is used, which, as usually employed, is well known to be detrimental to the belt; but the manner in which the jockey pulley is used with the Lenix system is so different that the ordinary experience with jockey pulleys is no guide to the merits or demerits of Captain Leneveu's system.

Assume an ordinary belt drive, as in Fig. 2, where *A* is the driving pulley and *B* the driven pulley. If the ratio of the diameter of *B* to the diameter of *A* is large it is necessary to make the distance *L* large also, and further, to provide that the top side of the belt shall be the slack side, because it is essential to secure as large an arc of contact of the belt on the small pulley as possible; otherwise, the belt must be drawn up very tight to prevent slip. In the case of a very short drive, in which the belt will naturally slip very much, what is often done is to jam a jockey pulley anywhere on the tight side of the belt, as in Fig. 3, so that the tension of the belt is increased until the slipping stops or the belt breaks. A jockey pulley in this position does not increase the arc of contact to any extent. All that it does do is to increase the tension in the belt and this increases the frictional effort at the expense of the belt.

A better though more unusual position for the jockey pulley is on the slack side of the belt as near the small driving pulley as possible, as is shown in Fig. 4. Here the arc of contact is increased as well as the tension in the belt; the arc of contact is naturally the most important factor. This arrangement of jockey pulley might perhaps be satisfactory if the conditions remained absolutely constant, that is, if the belt was without any stretch and the power transmitted was absolutely constant. In practice, however, these ideal conditions never exist, and even in the best cases of the employment of ordinary jockey pulleys, a bad drive is improved only at the expense of belts, bearings, etc.

In the Lenix system, the jockey pulley is placed on the slack side of the belt as near the circumference of the smaller of the pair of transmission pulleys as is practicable. The Lenix pulley is not fixed but is carried on an arm which rotates about the same center as the smaller of the driving pulleys, as shown in Fig. 5, and thus it floats on the belt. Just such a weight as will give sufficient tension on the slack side of the belt to prevent slipping is carried by the arm, the tension being regulated by the leverage to which the weight is set. A very large arc of contact is obtained, and very little tension is required in the slack side of the belt to transmit the power, usually about one-tenth of the circumferential driving force being sufficient.

When the power to be transmitted increases, the tension on the tight side of the belt increases, and some of the material is transferred from the tight to the slack side of the belt, increasing the length of that side with the immediate results that the Lenix pulley drops and takes up the slack, at the same time automatically enrolling the belt further onto the smaller pulley and insuring a greater arc of contact for the greater power being transmitted.

Another advantage of the Lenix system is that it overcomes those troubles

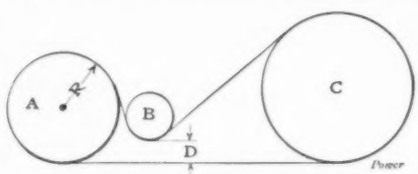



FIG. 7. EFFICIENT ARRANGEMENT OF PULLEYS

in ordinary belt drives due to centrifugal force which causes the belt to leave the surface of the pulley, thus diminishing the contact and allowing slip to occur unless the initial tension is sufficient to prevent it. Owing to the action of this force, it is not often possible to use heavy belts at high speed.

Quite apart from the theoretical tension that exists in a belt, due to the power transmitted, it is necessary in almost every case to provide an initial tension to allow for stretching and the consequent slip. This tension may be as much as five, six or even ten times as great as the actual circumferential driving power. The belts, shafts, bearings, etc., have accordingly to be designed to support such a tension. With the Lenix system, the tension of the slack side of the belt need only be one-tenth of the circumferential driving force, and thus the tension on the tight side is only 1.1 times this same force. In practice, belts of the Lenix system have been designed for twice the circumferential driving force and have proved entirely satisfactory. Extremely light belts may, therefore, be employed. In some cases the adoption of the Lenix system has resulted in the use of belts only one-quarter as large in section as those previously necessary for the same drive.

Apart from this, a still greater economy is obtained in length, as the driving pulley and the driven pulley may be close together, the only space required being room for the Lenix pulley, 20 inches between the rims of the two being ample. This means economy in floor space, and indeed where motor driving is employed, it is often possible to fix the motor overhead immediately adjacent to the driving pulley; for instance, near the main shaft instead of on the floor, and thus to keep the whole of the floor space available. As smaller-diameter pulleys may be used, faster and therefore cheaper motors may be employed. Loss of power by friction in bearings is reduced too, as the tension is so much smaller than in ordinary drives. This economy sometimes amounts, in practice, to as much as 10 per cent. of the power transmitted. For the same reason, the shafting may be much lighter; the wear and tear is consequently reduced.

An objection sometimes raised is that the frequent reversal of the belt will ruin it, but such destruction does not actually occur; belts have been in use for many years on heavy duty without showing signs of wear. A little consideration will show that the wear of the belt from this cause could not be serious, for the tension at the point of reversal is very small.

All kinds of belt materials may be used with the Lenix system, but the belt must be made continuous and as thin as practicable, the necessary strength being secured by increasing the width rather than the thickness, so that it may be as supple as possible. Leather is to be preferred and the joint may be made as shown in Fig. 6, the ends being well connected together.

The belt should be of such length that the distance *D* equals radius *R*, Fig. 7, thus allowing for a lengthening of the belt after starting, the value of *D* when the belt is working being generally about equal to the radius of the Lenix pulley *B*.

Vertical drives are usually unsatisfactory because the initial tension has to be made large owing to the weight of the belt reducing the contact between the belt and the lower pulley; but with the Lenix pulley this is overcome, and vertical drives are equally as satisfactory as others.

The speed ratio obtainable with a single pair of pulleys is limited only by the practicable size of the larger pulley and indeed ratios up to 30 to 1 have been successfully employed.

The slip with the Lenix system is never more than 1 per cent., which is due to the creeping of the belt and is inherent to all systems of belt driving where materials which stretch are employed. When a Lenix drive is stopped, the belt has no strain on it and only has the strain of the effort transmitted while in motion.

# A Method of Finding Sizes of Rolled Thread Screw Blanks

*Only an Approximate Diameter Formula Can Be Derived*

By J. F. Springer

Accepting the proposition that the volume of a given length of a helix of given section and diameter is constant, whether the coils are a mile apart, or just touching, or in the form of annular rings, the problem of ascertaining the volume of a helical thread reduces to the problem of finding the volume of the comparable annular ring.

The form of the axial section really has no effect. An immediate consequence of this is that we can get the volumes of all the different varieties of threads in precisely the same way—by calculating the volume of a ring having the same axial section. Indeed, we can get the volume of a convolution of the *groove* in precisely the same way.

Now if the thread or groove is generated by an ordinary isosceles triangle, then the volume of a ring is easily obtained by ordinary methods. Thus, let *A B C* in Fig. 1 be the generating triangle of a thread, whose gage is 2*R*. It is easy to see that the volume of the thread ring may be obtained by taking the volume of the cylinder whose base is a circle of radius *r* and whose altitude is the pitch *p* and subtracting it from twice the volume of a frustum of a cone whose

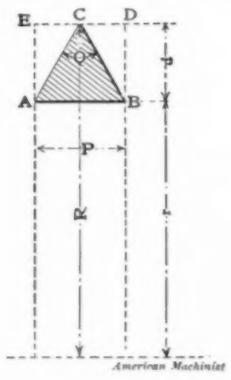



FIG. 1. DIAGRAM OF SECTION OF THREAD HELIX WITH NOTATION

larger base is a circle of radius *R*, whose smaller base is a circle of radius *r*, and whose altitude is ½*p*. We thus get,

$$T = 2 \times \frac{\pi}{3}(R^2 + Rr + r^2) \times \frac{p}{2} - \pi r^2 p.$$

$$T = \frac{p\pi}{3}(R^2 + Rr - 2r^2).$$

$$T = \frac{p\pi}{3}(R - r)(R + 2r). \qquad (1)$$

In order to obtain the volume of the *groove* convolution all we have to do is to subtract *T* from the volume of the ring generated by the rectangle *A B D E*. We thus obtain

$$G = (\pi R^2 p - \pi r^2 p) - \frac{p\pi}{3}(R^2 + Rr - 2r^2)$$

$$G = \frac{p\pi}{3}(2R^2 - Rr - r^2).$$

$$G = \frac{p\pi}{3}(R - r)(2R + r). \qquad (2)$$

Let us now consider how we may employ these formulas in the determination of the size of wire to use in order to get a given size rolled-thread bolt.

In Fig. 2 let *A B* be the line of the summits of the finished thread; let *C D* be the line representing the edge of the stock used; and *E F* be the line of the bottom of the thread. In this sectional view, then, *Y* will represent the material

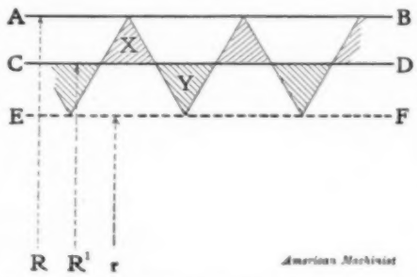



FIG. 2. DIAGRAM OF SECTION OF ROLLED THREAD WITH NOTATION

displaced by the entering die, while *X* will represent the extruded material. If the process of thread rolling produces no elongation of the bolt blank and if there is no compression—or if these are negligible factors—then a convolution of thread *X* should be precisely equal to a convolution of groove *Y*. By formula (1) we may calculate the one, and by formula (2) the other. Let $R_1$ be the radius of the stock. We have now to remember in using the formula that *r* in formula (1) will be replaced by $R_1$, and *p* by $p_1$, where $p_1$ is the base of the triangle *X* (Fig. 3). We thus get

$$X = \frac{p_1\pi}{3}(R - R_1)(R + 2R_1). \qquad (3)$$

Similarly, we obtain from formula (2) the volume of a groove convolution *Y*. We must remember here that *R* is to be replaced by $R_1$. We thus get

$$Y = \frac{p_2\pi}{3}(R_1 - r)(2R_1 + r). \qquad (4)$$

We now write *X* and *Y* as equal to each other, and thus obtain,

$$\frac{p_1\pi}{3}(R - R_1)(R + 2R_1) = \frac{p_2\pi}{3}(R_1 - r)(2R_1 + r). \qquad (5)$$

Referring to Fig. 3, we observe that the triangles *X* and *Y* are similar. If we note that their respective altitudes are $R - R_1$ and $R_1 - r$, we have, then,

$$\frac{p_1}{p_2} = \frac{R - R_1}{R_1 - r}.$$

From this we obtain,

$$p_2(R - R_1) = p_1(R_1 - r)$$

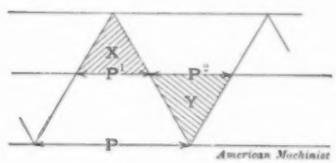



FIG. 3. DIAGRAM OF THREAD AND GROOVE OF ROLLED THREAD

Multiplying equation (5) by this and dividing

$$\frac{\pi p_1 p_2}{3}$$

out, we get

$$(R - R_1)^2(R + 2R_1) = (R_1 - r)^2(2R_1 + r).$$

Expanding, we get

$$3R_1^2(r - R) = r^3 - R^3.$$

Dividing through by $3(r - R)$, we obtain,

$$R_1^2 = \frac{R^2 + Rr + r^2}{3}.$$

Whence,

$$R_1 = \sqrt{\frac{R^2 + Rr + r^2}{3}}. \qquad (6)$$

We may write the formula in terms of the diameters instead of the radii,

$$D_1 = \sqrt{\frac{D^2 + Dd + d^2}{3}}. \qquad (7)$$

### CONSTANT FROM EXPERIMENT

This formula enables us to ascertain the gage of stock to use for a given rolled-thread screw having given the gage of the exterior of the thread desired, *D*, and the gage of the core of the finished screw *d*. It must be remembered, however, that it is based on the assumptions that the elongation of the screw and the compression of the material are both negligible. If the material is such that, in fact, these elements of the problem are not to be disregarded, then the formula will give results too small. The formula assumes that *all* the material displaced by the ridges of the die at the bottom of the groove reappears as extruded metal at the summit. If indeed there is appreci-

able elongation or compression, then a portion of the material does not thus reappear. The formula is to be used, then, as needing a slight correction. This is to be sought in actual experiment. If we denote this factor of correction by $K$, we may write,

$$D_1 = K\sqrt{\frac{D^2 + Dd + d^2}{3}}, \qquad (8)$$

and regard this as final. The value of $K$ will be slightly in excess of unity and should be determined by actual experiment.

### Formulas in Other Terms

It may be convenient to have this formula in terms of $D$ and $h$, where $h$ is the altitude of the triangle of generation. We have

$$D - d = 2h$$

From this we get

$$d = D - 2h$$

Replacing $d$ in formula (8) by this value, we obtain

$$D_1 = K\sqrt{\frac{3D^2 - 6Dh + 4h^2}{3}}. \qquad (9)$$

Further, we may write it in a different form, if we make use of the fact that $\frac{1}{2}p$, $h$ and $\frac{1}{2}Q$ are two sides and an angle of a right triangle, see Fig. 1. We have

$$\frac{h}{\frac{1}{2}p} = Cot.\ \tfrac{1}{2}Q.$$

So that

$$h = \tfrac{1}{2}p\ Cot.\ \tfrac{1}{2}Q$$

Substituting this value in formula (9), we get

$$D_1 = K\sqrt{\frac{3D^2 - 3Dp\,Cot\,\frac{1}{2}Q + p^2\,Cot.^2\frac{1}{2}Q}{3}} \qquad (10)$$

If the thread is a 60-degree V-form, then $\frac{1}{2}Q$ is 30 degrees and the cotangent is $\sqrt{3}$, so that we have

$$D_1 = K\sqrt{\frac{3D^2 - 3\sqrt{3}Dp + 3p^2}{3}}.$$

$$D_1 = K\sqrt{D^2 - \sqrt{3}Dp + p^2}. \qquad (11)$$

The three formulas (8), (9), (10) are equivalents of each other, and it is merely a matter of convenience which is used. The value of $K$ is the same for each and also for (11). An inspection of formulas (8) and (9) will show that it is possible to vary the pitch or the vertical angle of the generating triangle without changing the value of $D_1$.

Formula (8) may be put into another form, which will, perhaps, reduce numerical calculation somewhat. We may write

$$\frac{D^2 + Dd + d^2}{3} = \frac{D^2 + Dd + d^2}{3} \times \frac{D - d}{D - d} = \frac{D^3 - d^3}{3(D - d)}.$$

So that we may now write

$$D_1 = K\sqrt{\frac{D^3 - d^3}{3(D - d)}}. \qquad (8')$$

Now we may likewise write (9) in a different form. From $D - d = 2h$, we get $d = D - 2h$. Making use of these, we obtain form (8′)

$$D_1 = K\sqrt{\frac{D^3 - (D - 2h)^3}{6h}}. \qquad (9')$$

Replacing $h$ by $\frac{1}{2}p\ Cot.\ \frac{1}{2}Q$, we get

$$D_1 = K\sqrt{\frac{D^3 - (D - p\,Cot.\frac{1}{2}Q)^3}{3p\,Cot.\frac{1}{2}Q}}. \qquad (10)$$

Formula (11) could also be transformed, but it is perhaps already in its most advantageous form. Formula (8′) is, perhaps, the most convenient of all to use.

### An Illustrative Example

Let us use it in an actual case. Suppose we want to roll bolts whose gage when finished shall be 0.25 inch, and which shall have 20 threads per inch, the style of thread being 60-degree V-shaped. We look in our tables of bolt threads and find that the gage of the core of such a bolt is 0.1634 inch. This is the value of $d$. So that we have, by formula (8′), assuming that elongation and compression are both negligible (i.e., $K = 1$),

$$D_1 = \sqrt{\frac{(0.25)^3 - (0.1634)^3}{3(0.25 - 0.1634)}} = \sqrt{\frac{0.015625 - 0.004363}{0.2598}} = \sqrt{\frac{0.011262}{0.2598}} =$$

$$\sqrt{0.043310} = 0.208\ inch.$$

If, however, we do not happen to have a table showing the gages of the cores, we may use formula (10) or (10′). Both of these are proper formulas, whatever the vertical angle of the generating triangle. For the present case where that angle is 60 degrees, we may use formula (11) and simplify the work. We assume, as before, that $K = 1$. Knowing that there are 20 threads to the inch, we get the pitch at once.

$$P = 1/20 = 0.05.$$

We now write

$$D_1 = \sqrt{(0.25)^2 - (\sqrt{3})(0.25)(0.05) + (0.05)^2}$$

$$= \sqrt{0.0625 - 1.73205 \times 0.0125 + 0.0025}$$

$$= \sqrt{0.043349} = 0.208\ inch.$$

This is the same result as before, as, of course, it should be, and we seem to have gotten it more easily. But we must remember that we made use of a special formula good for 60-degree forms.

The method used before is available whatever the angle, and it would not be lengthened by a variation from 60 degrees.

If we have a different angle and should not have a table of core dimensions, we may use formula (10). Thus, suppose the angle is 50 degrees. If the pitch is the same as before (0.05 inch), we write

$$D_1 = \sqrt{\frac{3(0.25)^2 - 3(0.25)(0.05)\,Cot.\,25° + [(0.05)\,(Cot.\,25°)]^2}{3}}.$$

$$D_1 = \sqrt{\frac{0.1875 - (0.0375)(2.1445) + (0.107225)^2}{3}}.$$

$$D_1 = \sqrt{0.039526} = 0.199\ inch.$$

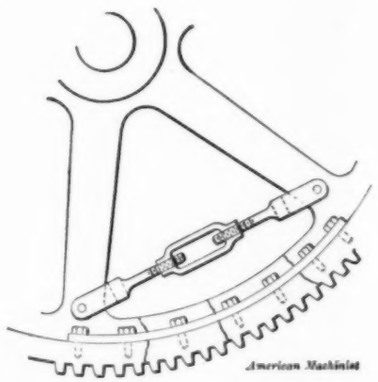
It will be seen, from a consideration of these examples, that the gage of the stock required is much less than that of the thread desired. Thus, to get a screw thread of ¼-inch gage and a 60-degree V-thread of 20 turns per inch, stock of 0.208 inch is required. If the angle is 50 degrees, a less diameter will suffice. However, elongation and compression may really be present, so that we shall have to use blanks of a slightly larger diameter.

## An Emergency Gear Repair

By C. W. Putnam

The accompanying sketch is of a quick repair job of a spur gear. This gear is one of a series of dryer gears on a large paper machine.

This gear broke one day about 1:30




An Emergency Gear Repair

a.m., and at 6 a.m. the paper machine was again doing business.

It seems the company had no extra dryer gears in stock, so the master mechanic was called up, came to the mill and started the repair of this gear immediately. He found two old steam-pump valve-rod heads and a turnbuckle. It was a short job to thread two rods to suit the turnbuckle. While he was preparing this the other men were drilling and tapping the holes in the rim of the gear, also forming the steel straps, one on either side, bolting the broken pieces in place and screwing up the turnbuckle. Thus they had the gear repaired.

The company immediately ordered two more extra gears, but have no occasion to put them on as this one was doing good work.

This gear, the master mechanic told me, was broken some two years ago.

# Some Points on Cold Rolled Shafting

*By Chas. C. Klein*

When the patents expired under which the firm of Jones & Laughlin, of Pittsburg, operated, there was a tremendous rush on the part of many steel mills to compete in the manufacture of round cold-rolled steel. Every manufacturer of transmission machinery was deluged with circulars setting forth in glowing terms the advantages of cold-rolled bars. They were guaranteed to be perfectly round and straight, of a superior finish and were to be accurate to gage within 0.001 of an inch.

Some of these circulars were reinforced with certificates of laboratory tests by prominent college professors, giving minute results as to the great increase in tensile and compressive strength by the cold-rolling process; they stated that the resiliency had been increased many times, and the tendency to spring in keyseating had been eliminated entirely.

Manufacturers of turned shafting looked upon these developments with a great deal of suspicion and did not buy as freely as was anticipated, hence cold-rolled shafting soon became a drug on the market and, as a natural consequence, prices dropped to such a level that, finally, it was offered at almost the price of rough-steel bars.

This made the position of the manufacturers of turned shafting an embarrassing one. Power users, who had also been educated by floods of circulars, would have nothing but the cold rolled, it being so much cheaper and was alleged to be so much better than turned shafting, that it was next to impossible to secure an order for turned shafting.

### Trial Order

We had a specially designed and very effective shafting lathe and superior facilities for handling, but the margin between cold-rolled shafting and rough-steel bars was so exceedingly small that more money could be made by buying the cold-rolled article than by furnishing turned shafting and, accordingly, a small trial order, amounting to less than $500, was given.

With the exception of one short piece, all the shafting ordered was 1 $\frac{11}{16}$ and 1 $\frac{15}{16}$ inches in diameter and in 16-foot lengths. When it was delivered, Jim, the foreman, was on hand to inspect the purchase. Everyone admitted that it was nice looking stuff, but Jim pulled one of the shafts out and grasped it strongly between his forefinger and thumb. Running his hand thus around the shaft he exclaimed: "This stuff ain't round by a long shot," and disappeared in the shop. After awhile he reappeared with a handful of waste and a half hanger box, coated on the inside very thinly with a mixture of lampblack and oil. After wiping the shaft carefully he rubbed the box on the shaft lengthwise and around its circumference and numerous black streaks upon its surface showed unmistakeably that its section was much closer to a many-sided polygon than to a circle. The streaks did not run parallel with the axis but formed helical lines of a very coarse pitch.

### Placing Shafting in a Shop

The agent of the steel manufacturers was sent for and, of course, minimized the evidence of the suspicious looking streaks as much as possible and through his extraordinary persuasiveness induced us to give the stuff a trial.

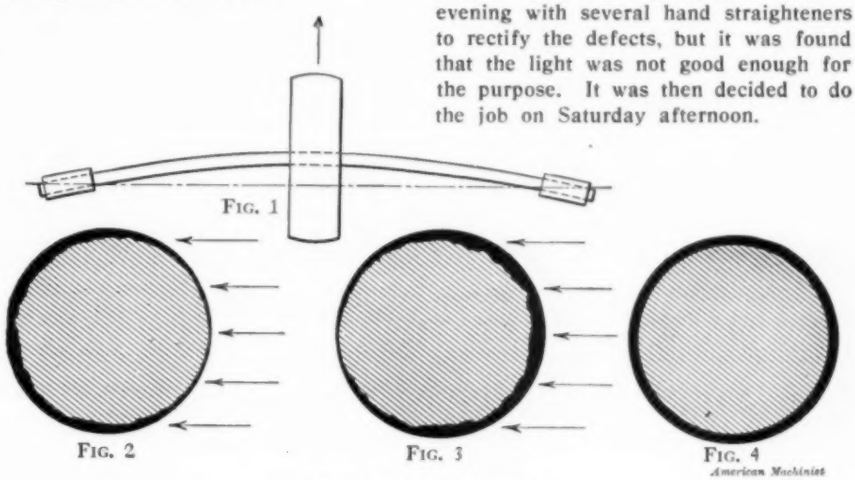


Fig. 1

Fig. 2 Fig. 3 Fig. 4

American Machinist

Cold-rolled Shafting

As a special precaution the shafting was put into the straightening machine, both before and after keyseating and, so far as straightness was concerned, a finer lot of shafting was never delivered from any shop. At last the shafting was erected with rather more than ordinary care. In starting up the only suspicious circumstance that manifested itself was a slight humming noise caused, no doubt, by want of roundness, but this was effectually drowned when the machinery was in operation.

A few weeks after this, word came from the mill to send someone to inspect the shafting as it was making a big noise and some of the belts flopped badly.

### Defects in Shafting

To anyone familiar with transmissions and knowing what shafting ought to be, this roomful was certainly everything that it should not be. Numerous crank motions could be noticed in it at a glance. The noise above the hum of the machinery was appalling. A 24x6-inch pulley, not more than two feet from a bearing, danced up and down about a quarter of an inch and with every jump made a racket that put to shame the best plantation darkey that ever performed a jig on a board.

As the discrepancies were greatest in the vicinity of pulleys, the accusation was made that the belts had been unduly tightened. This was vigorously denied; in fact, it was stated that the belts had not been touched by anyone in the mill since the installation of the job. The proprietor of the mill was in a rather ugly mood. Unless the shafting could be put into good order at once, we were requested to remove it.

The mill would not stop except Saturday afternoons and Sundays. Under these circumstances it was thought advisable to send a gang of men that evening with several hand straighteners to rectify the defects, but it was found that the light was not good enough for the purpose. It was then decided to do the job on Saturday afternoon.

On Monday morning the mill started in good shape with the exception of trifling bends in the shafting in several places. As there was much apprehension felt in regard to the job, a representative was sent once or twice a day to watch developments. Every day he reported conditions as getting worse and, before Saturday came, things were as bad as during the previous week.

### Replaced by Wrought-iron Shafting

It was then concluded to spend only enough time at the damaged shafting to make it hold together until wrought-iron shafting could be turned and put in its place.

In a week this was accomplished and the new shafting was erected in precisely the same conditions as the cold-rolled stuff; not a coupling, pulley or hanger being changed or moved from its position. When it was started up not the slightest noise could be heard, no bend of any kind could be detected and the whole room showed in every part a well planned and a well executed transmission job and for over fifteen years it has not cost a dollar for repairs except for belting and it seems today as perfect and true as when it was started.

The discarded cold-rolled shafting was sent back to the shop to be cut up and sold for countershafts of five feet and under, and no further trouble was experienced with it.

### Causes of Difference

Now your readers will want to know what caused the astounding difference in the behavior of the cold-rolled steel and the iron-turned shafting. I regret to have to confess that I do not know. I have simply given a plain statement of the facts but will venture to suggest a theory deduced from a very long practical experience with cold-rolled steel, turned steel, turned bar iron and turned hammered iron.

Broadly speaking, a piece of shafting to be right and to stay right must be a dead shaft. By this is meant that it must be entirely free from inherent strains, internal as well as external. No shaft answers these conditions better than one turned from a hot-rolled iron bar, or from a thoroughly annealed piece of iron or steel.

Were shafting subject only to torsional strains in doing its work, the matter of either internal or skin strains could largely be ignored, but shafting, especially in the vicinity of belts, is subject to transverse strains also, and it revolves under these strains.

To make the matter more clear let us examine Fig. 1, which shows, in a greatly exaggerated form the transverse strain produced by the belt and the deflection of the shaft. If the pull of the belt is uniform, and the shaft is equally strong in all radial directions, no jumping or eccentric motion would be detected in its motion, but to all appearances it would run true. Without doubt, it would in time crystallize and break where the bending moments are greatest, namely in the hub of the pulley.

### Advantages of Wrought Iron

A wrought-iron turned shaft will stand this transverse strain, ever changing radially during each revolution, the longest. A wrought-steel shaft, while, perhaps, capable of bearing a heavier transverse strain, will crystallize and break sooner, all other things being equal. But what of a shaft which is not equally strong in all radial directions?

Simply this, it will give way a little in the weakest direction at every revolution until a permanent set or head is produced. This is precisely what occurs in low-grade cold-rolled shafting and gives rise to those mysterious phenomena which have been described.

When the rough bar from which the cold-rolled shaft is made is very uneven, lumpy or out of round, it follows that the compressed skin which is formed during the process of cold rolling, is much thicker at the protuberances of the rough bar than at the depressions, and, whether the tensile or the compressive strength of the skin is increased does not matter as the result is influenced entirely by the difference with which the shaft is capable of resisting transverse strains in diametrically opposite directions.

In Figs. 2 and 3 is certainly indicated that the shaft with the uneven skin will be acted upon by transverse strains with entirely different effects in the two figures which show the same shaft after making a half revolution.

### Some Good Cold-rolled Shafting

I do not mean to state nor to imply that all cold-rolled shafting is affected as described. I have used many thousands of feet of cold-rolled steel and have found much of it equal to wrought iron in keeping straight, superior in finish, but more liable to bend in key-seating and to crystallize.

That these good qualities are produced by technical skill and financial resources of the manufacturers is perhaps made evident by the fact that quite a number of makers of inferior cold-rolled shafting had to be ignored in placing orders.

# Dies for Perforating Music Rolls

*By Frank Greiner*

The die as shown in Fig. 1 herewith was used to perforate music rolls for self-playing pianos, thirteen sheets at a time, and differs from those commonly employed for this purpose in so far that the specifications called for the hardening of the working parts of the die. As a rule they are left soft, a tough steel being used.

There were 66 punches, 6 to the inch, and the specifications furthermore called for an absolutely perfect alinement, and a thickness of No. 33 drill rod for these punches, which naturally left very little space between them.

It is evident that the die could not have been made solid, as it would have sprung badly, even by employing the local-hardening process; and the insertion of bushings did not look very feasible on account of the scant amount of stock between the bushings and the accompanying difficulty of obtaining a snug fit for them. It was therefore decided to make the die in sections, which plan offered the possibility of the users being able to substitute new sections when necessary.

### A Jig for the Die Sections

The feature which will probably interest the reader most, as it can be applied to many drill jigs, is the jig used to produce an unusually perfect alinement of the holes in the die. Instead of spacing the six holes by the usual cut and try method, six bushings, a few thousandths smaller inside and a few thousandths outside, were made and hardened. They were then lapped inside to the exact size of the spotting drill, which was a few sizes smaller than the diameter of the punches, and ground on the outside, perfectly concentric with the holes, and exactly ⅛ inch in diameter.

A steel block, *O*, Fig. 2, was milled to receive the six bushings without play, as well as the die blocks. As it measured exactly 1 inch in length, it was merely necessary to fasten two plates, *P P*, to the open sides, and after the two screw holes and the two dowel-pin holes had been drilled, the jig body was case-hardened, the six bushings inserted and the jig was ready for business.

### Making the Sections

The die blocks were cut off from a strip of Jessop tool steel, after this had been milled all over, and the ends were squared up, using a quickly made milling jig for holding them to insure interchangeability and squareness. In order to bring them up to exact size, they were "micrometered" both ways, and fitted nicely into the jig. Before this was done however, they were annealed, in order to minimize the possibility of distortion in the final hardening.

An ordinary twist drill was used to spot the holes in the die blocks, which were afterward reamed with a larger size drill and then with a taper reamer. As twist drills have the well known tendency to run off, the tops of the blocks where the spotting drill entered were marked and the reaming was done from the opposite side, so that all the holes were in line.

The hardening of the dies offered no difficulties whatever, as the blocks were heated only to a very dull red and covered with cyanide of potassium before plunging into hot water. In order to obtain an even heat, they were heated in a lead bath and the scale which formed in plunging was washed off with soap water. They were then drawn to a light straw color. The total variation was an expansion of one thousandth inch which was corrected by grinding with a small disk covered with emery cloth, holding the blocks down on the rest of the speed lathe.

### The Die Block and Other Parts

The cast-iron die bed *A*, Fig. 1, is so simple that it requires no description. *B* is the stripper, made of cold-rolled steel, ⅝ inch thick, giving the punches a sub-

stantial guiding surface. *C* is the upper guide plate, also of cold-rolled steel, 3/8 inch thick. As explained in a previous article, cold-rolled flats can be had from almost any supply house so accurate in dimensions, as well as straight, that it has often struck me as a waste of time and money to plane, shape or mill a piece of steel for any similar purpose, if stock sizes can be used.

*I* and *J* are the two bolts holding the different parts of the die together. *E* and *F* are two bushings maintaining the proper distance between the upper guide plate and the stripper; while *G* and *H* answer the same purpose between the die proper and the stripper, this being the space allowed for passing the thirteen layers of paper to be operated upon between die and punches.

### The Sixty-six Punches

The 66 punches *K* are selected lengths of drill rod, the uneven and under- or over-sized pieces being thrown out. In order to prevent the metal from distorting, the V-shaped cutting parts were not milled but filed, and a small piece of tool steel with a screw on the side for holding the punches while filing. and a V filed in for guiding the file constituted the jig. This was hardened glass hard, clamped in the vise and the punches were passed through a hole in the center of the V and filed, but not to a sharp edge. They were hardened in a lead bath on the cutting points only and then ground out with a small emery wheel.

It will be noticed that the long, cross-sectional view of the die shows the punches perfectly straight, whereas in reality a shoulder or recess was turned to receive the small brackets. These brackets are made of two pieces of strip steel, formed to the curvature of the round rods as shown and riveted together. They serve the purpose of raising the punches after the down stroke, being engaged by a lever, not shown, the small pins *M* keeping them from turning. The cross-section to the left will make this plain. *D* is a section of one of the two braces spaced equally between the bushings *E* and *F*, which keep the stripper and upper guide plate from springing.

### Transferring the Holes

In transferring the punch holes the following procedure was observed: The die blocks, Fig. 3, were inserted in their groove in the cast-iron, starting on one end, the screw holes for the first one being drilled and tapped, the screws put in place and the next block placed alongside of the first. To make sure that the proper distance was maintained, one of the die blocks was used as a gage, by laying it across the two and passing two of the punches through, one in each block, then it was taken off, the holes for number two were drilled and tapped, and so on until all the blocks were in place. As the blocks fitted tight into the groove, it was not necessary to clamp them down while drilling.

The stripper *B* was placed on top of the die, using the bolts *I* and *J*, to locate it, and the holes were spotted in the stripper through the back of the die blocks; the stripper was then removed from the die and the holes were drilled and reamed. It was then put back on the die, and the upper guide plate placed on top, in its natural position, the bolts being used again for locating, and the spotting and drilling operations were repeated through the back of die and stripper in a similar manner.

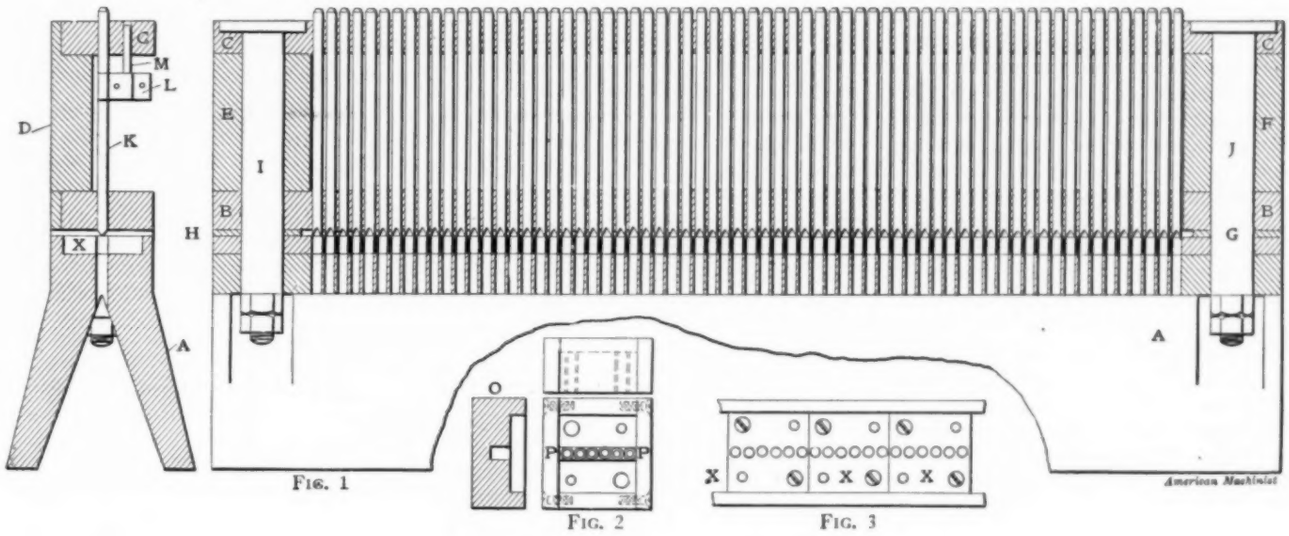



Fig. 1 Fig. 2 Fig. 3

Dies for Perforating Music Rolls

# High Cost of Real Information

*By Con Wise*

An education is a valuable thing. It certainly is costly. Just for the amusement of it I set down the cost of mine as far as I have gone. Here it is:

Cost to find out that machine screws and milled screws do not interchange, $3; that V- and U. S. standard threads won't interchange, $8; that steel won't run on steel unless one part is hardened, $10; not to case-harden crucible-steel castings, $20; how to make out a bill of lading, $12; that people use diametral-pitch gearing, $20; that you cannot hob less than 30 teeth on a worm gear (it is not so), nothing; that two planer heads feeding opposite ways cannot pass on one rail, $50; not to quote price "alongside ship" when I meant "on dock," $125; that rebates are not all done away with, $150; not to borrow money on demand unless I could pay it on demand, $500; that the asking price of a firm that is in a combination is not the bottom price (cheap at that), $2000; that a man is not necessarily square because he says he is, *all the rest I had.*

Education is certainly expensive. I would suggest that some of our technical schools take up a few of these things. It might pay!

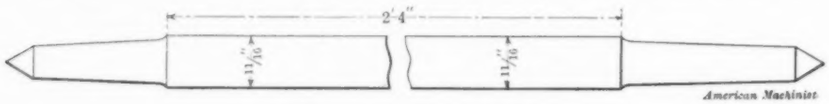
# Letters from Practical Men

**Concerning the Details of Making Things in Machine Shops from the First Sketch to the Sale**

## Grinding Textile Machine Spindles

There is a branch of the engineering business in which the salesman of modern machine tools rarely gets a show, namely, the textile-machine trade, and he sometimes receives a rude shock on finding that with the most primitive of home-made tools an output is obtained that equals or even puts his own imagined novelties into the shade. There may appear to be a lack of refinement about this business as some of us understand it, but if I was on the lookout for ideas for any new mechanical contrivance I should sooner expect to find it in an old-established textile shop than I would in the most modern and enterprising establishment.

These primitive tools have in most cases been designed for some particular job in one shop and have been copied or improved upon in an adjoining one, and it would be hopeless to keep their special features secret in the trade if it were desired. This happy condition arises, at least in England, from the fact that almost all these shops lie in a very limited area and the somewhat limited migration of workmen leads to their principles soon becoming common property. Something like the same thing applies to the workmen themselves, for they are bred from a race of textile workers and would seem to inherit a special instinctive skill and speed. Many modern machines are constructed on imagined new principles which have actually been in operation in these shops for years where their value for other purposes has never been considered.




SPINDLE TO BE GROUND

### GRINDING A MULE SPINDLE

A job which may be of some interest in this particular business is the grinding of the ordinary mule spindle shown in the sketch. These spindles, which are of a high quality of drawn cast-steel rod, are supplied in proper lengths and with some 0.015 inch to remove from the diameter. The ends are first swaged down and the center pointed and they are then ready for grinding. For this purpose they were first placed in a pair of hollow centers with a wooden back rest brought to bear on the middle portion and with a sandstone wheel they were just trued up for a length of about 3 inches in the middle and were then brought to the finish-grinding machine. This consisted of a moving table, with hand feed mechanism, carrying headstock and footstock and one steady rest in the form of two half shoes which held the spindle rigidly as shown. The finishing wheel was also of sandstone and of 2½ inches face by 30 inches diameter, the spindles were ground dry, by hand traversing the table, at the rate of 8 per hour and the method of cleaning the wheel as it became glazed was an eye-opener. For this purpose a piece of fat bacon was kept handy on the work table and if the rod began to become discolored with heat the operator touched the face of the wheel with the bacon and it was instantly cleaned. Pig meat must contain some special properties for this work for I am told no other kind of animal fat has the same effect. The spindles were ground to a snap gage and afterward lapped to a ring gage with lead clamps and oil and emery at the rate of 30 per hour.

### MODERN EQUIPMENT

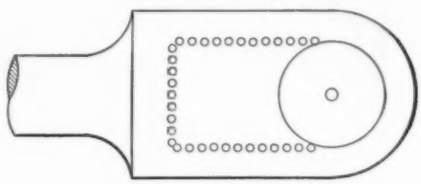
Some little negotiation induced the installing of a 6x32-inch Norton machine for grinding these spindles, with very gratifying results. The first saving came from the spindles not requiring spotting off true in the middle. They were brought direct to the grinding machine, where they were supported by 6 half-round hardened-steel shoes spaced equidistant and were first roughed down within 0.002 inch with a 24-L wheel using the automatic cross feed. After some dozens had been roughed the wheel was trued up and they were finished to a snap gage, the time coming out at a little over 12 per hour. As the finish was decidedly good no lapping was required, which was a further saving.

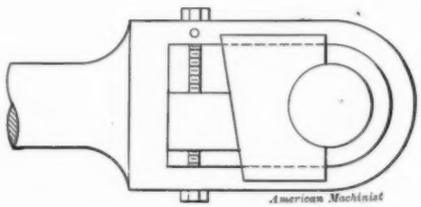
In grinding material of this description the surface scale on the steel is likely to give some trouble and cause the wheel to chatter. I find that it may be overcome by taking the first chip to a reasonably good depth, as one would in turning a casting, and so get below the scale.

Coventry, Eng. H. DARBYSHIRE.

## Necessity the Mother of a Connecting Rod

The other day I was talking on the above subject to an old mechanic who has done much to change and improve methods of doing work. Said he: "Forty years ago I had a small shop where I did a lot of repair work on agricultural machinery and steam engines. It wasn't much of a shop—a couple of old lathes, a shaper and a drill press. One day I got an order for a steam engine. It was going to be too much of a job to build the connecting rod in the old way with straps at each end secured by gibs and cotters, so I got the blacksmith to forge a head on each end of the rod, as shown in the line cut. It was an easy matter to drill and bore out the block of metal. My little shaper smoothed up the inside so that I could fit my brasses. The wedge was then fitted and the job finished."






THE CONNECTING ROD END

This was particularly interesting to me as I had recently been through several shops where hundreds of connecting rods of this type are turned out every year and I had also in my time fitted up many of the old style connecting rods with separate straps, gibs and cotters, and therefore knew the amount of misspent energy this man had obviated.

New York. E. A. DIXIE.

# Discussion of the Previous Question

**Letters from Our Readers Showing How Many Men of Many Minds Look upon Various Subjects Opened up in Previous Numbers**

## Growth of Workmen's Compensation Laws

With reference to our editorial on page 844, a correspondent has called our attention to a compensation act that went into effect on January 1, 1910, in the province of Quebec, Canada.

The act is comprehensive, excluding only agricultural industries and navigation by means of sails. To show the amount of the compensation to be paid articles 2 and 3 of the act are given below:

2. In cases to which article 1 of this act applies, the person injured is entitled:

*a.* In case of absolute and permanent incapacity, to a rent equal to 50 per cent. of his yearly wages, reckoning from the day the accident took place, or from that upon which by agreement of the parties or by final judgment it is established that the incapacity has shown itself to be permanent.

*b.* In case of permanent and partial incapacity, to a rent equal to half the sum by which his wages have been reduced in consequence of the accident.

*c.* For temporary incapacity to compensation equal to one-half the daily wages received at the time of the accident, if the inability to work has lasted more than seven days, and beginnng on the eighth day.

The capital of the rents, shall not, however, in any case except in the case mentioned in article 5, exceed $2000.

3. When the accident causes death, the compensation shall consist of a sum equal to four times the average yearly wages of the deceased at the time of the accident, and shall in no case, except in the case mentioned in article 5, be less than $1000 or more than $2000.

There shall further be paid a sum of not more than $25 for medical and funeral expenses, unless the deceased was a member of an association bound to provide, and which does provide therefor.

The compensation shall be payable as follows:

*a.* To the surviving consort not divorced nor separated from bed and board at the time of the death, provided the accident took place after the marriage.

*b.* To the legitimate children or illegitimate children acknowledged before the accident, to assist them to provide for themselves until they reach the full age of 16 years.

*c.* To ascendants of whom the deceased was the only support at the time of the accident.

If the parties do not agree upon the apportionment of the compensation, it shall be apportioned by the proper court. Nevertheless every sum paid under article 2 of this act in respect of the same accident shall be deducted from the total compensation.—ED.

## Drafting Room Systems

It is with interest that I have read the articles of both Mr. Hart and Mr. Harris, recently published in the AMERICAN MACHINIST, in which these gentlemen advocate radically different systems of recording blueprints issued to various shop departments, and being a strong believer in the card-index systems, am inclined to favor the plan advocated by Mr. Hart. It appears to me that the scheme of filing in loose-leaf binders, a blueprint of each drawing issued to shop would soon grow into a cumbersome pile of binders, and in a large plant where numerous active drawings are required to meet the demands of constantly changing design and supplying repairs for old machines, this system would soon produce an enormous mass of blueprints which would have to be referred to from time to time, resulting in the wearing out of these prints, together with the objections already mentioned. In the plant where I am employed there are something like 12,000 drawings filed in the drawing-room vault. About 50 per cent. of these are more or less active and blueprints of them are required to be in the hands of the various shop departments. To meet the demands of a "ready reference" charge system was a problem which soon worked itself out and it is interesting to note that this system is in reality the one advocated by Mr. Hart, together with the one main feature suggested by Mr. Harris; that of having the department's receipt for the drawing, in each and every case.

| Dep't Number | Received | Quantity | Date of Issue | Date of Latest Replace | Date of Return | Drawing Number |
|---|---|---|---|---|---|---|
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| 2 | | | | | | |
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| Outside Prints | Date | Replace | Name |
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American Machinist

PRINT RECORD CARD

The head of each department is supplied with a punch, the same as used by railway conductors in canceling tickets; each department having a punch with a different symbol, by which such department is known. The man distributing the blueprints fills out the necessary cards for the prints he is issuing at the time, and secures the receipt at the time of delivery, in the form of a punched hole in the card directly after the department's number. The cards are then brought back to the drawing room, where they are filed consecutively, according to drawing number, in cases made expressly for the purpose.

A form of this card is here shown. That it is only three by five inches in size is a valuable feature, when we take into consideration the constantly growing condition of any recording system. It will be noticed that this card provides spaces for date of issue, date of any replacement or date of return of prints from any one department, thus giving an exact history of the blueprint from the time of issue until its return to drawing room. It has been my experience that these dates constitute a very important part in recording prints, especially the date of replacement, which shows at a glance whether or not the blueprint has been replaced after any change or correction has been made on the drawing.

J. WILLIAM JONES.

Painted Post, N. Y.

## Making Square Holes and Keying Sliding Worms

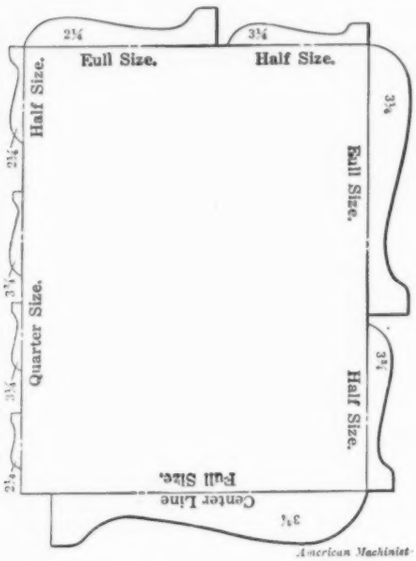
In regard to John W. Payler's article at page 793, I would like to say that the worm usually has a supporting bearing, at least at one end, and often at both, and this bearing or hole in which the shaft

must have a running and sliding fit is often in a large casting or part that cannot be handled in any machine.

Cleveland, O. A. NIELSON.

## Drawing Board Templets

On page 365 there is an article dealing with drawing-board templets. No doubt




CELLULOID TEMPLET FOR DRAWINGS

the templets shown there will save a lot of time in drawing, but I think that the following method will save still more.

My templets are made from celluloid similar to Mr. Kishpaugh's, but are not arranged in the same way. They are placed around the edge of the celluloid sheet and are actual templets to draw from; not merely to mark centers from.

On the particular one I have shown here, you will notice that three sizes of handle are given in three scales. Of course this method could be used for a great variety of standard parts.

These templets will take a little longer to make than Mr. Kishpaugh's, but they are so much quicker and more convenient in use. When using, there are no centers to be pricked through to drawing, and no compasses to be adjusted to the different radii. All that is required is to place the half handle in position required, with center line on templet, corresponding with center line on drawing and run pencil around. Then reverse templet and draw in other half of handle.

The curve, at end where handle joins the bar or screws into handwheel, is made to sweep out to a larger diameter than will be wanted on any ordinary lever or handle. This is done to make the templets available for handles on various sizes of bars.

When used for handles that screw into handwheels, the plain portion is drawn first and then templet matched up to it.

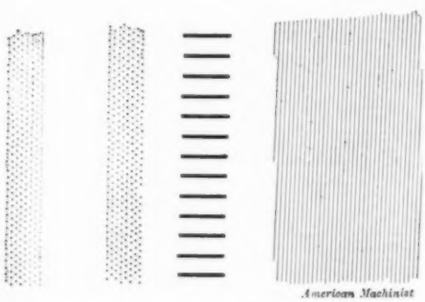
On practice, I find that these templets are great time and temper savers, for you get your handle in quickly and correctly.

E. H. ESCHMANN.

Coventry, Eng.

## Measuring Herringbone Gears

I was interested in the article by Charles H. Logue, on page 530, entitled "Angle and Lead of Herringbone Gears," but I think the method of obtaining the impression rather crude, as in cases of very small pitch one would be apt to fill up the spaces and as a result, get a smear or blur instead of a true impression. The method I generally use in such cases is to get a piece of carbon paper and insert it between two pieces of white paper; then roll the article on the top paper, which gives very good results in all cases, no matter how small the pitch, as will be seen from the accompanying prints. Fig. 1 represents a nurl impression; Fig. 2, an impression of a gear, while Fig. 3 is the point of a 20-thread screw. In this manner one gets the pitch required for milling flat dies,




CARBON PAPER IMPRESSION OF NURL GEAR AND THREAD

for rolling threads on screws, which is a very simple and correct way.

Urbana, Ohio. WALTER J. ILES.

## The "No Finish" Sign

On page 650, Mr. Kranz proposes a "no finish" sign and cites an extreme case where it might be useful.

I am of the opinion that such an abbreviation would be superfluous and prove of little ultimate value. For example: Let us assume a "no finish" sign as "y," and imagine an instance of work that is almost evenly divided (one-half finished, the other rough). Here, we certainly would not use both signs; if we use "f" we simply revert to current and standard practice; if we employ the "y" sign (as many draftsmen would probably prefer) what do we arrive at? Where is the service in this case to either draftsman, patternmaker or machinist? To both of these latter, doing a miscellaneous assortment of work from the drafting rooms of the many small concerns (who do not maintain a pattern shop and who have machine work done outside) it means that on one job he works to a finish mark and it properly calls attention to what must be done; on the other hand, he again works to a drawing on which he must finish parts that bear no notation, and in the portions which are marked he has no interest. Wouldn't this confuse rather than assist?

In the case quoted by your correspondent, I would suggest what I have often seen done and which never fails in its purpose (it also lets the draftsman off easily).

Let the single part not to be finished be marked "x" and on the drawing note "f all over except at x."

The average mechanical drawing has enough standard abbreviations and symbols attached without adding more.

L. R. W. ALLISON.

Los Angeles, Cal.

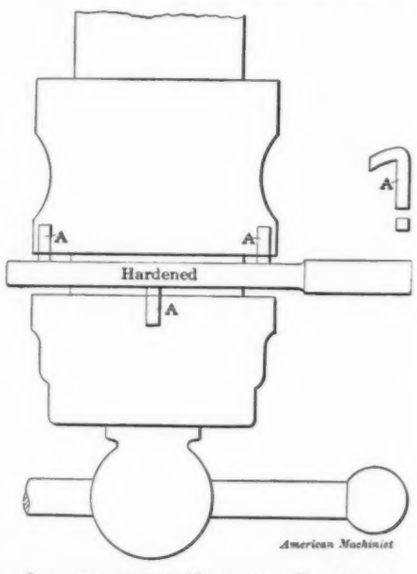
The question of adopting some conventional "no finish" symbol, is brought up by Mr. Kranz, on page 650.

To be of service, such a symbol should not have any resemblence to the conventional finish symbol "f," but it should have a suggestive relation to its own meaning. So, if a symbol is considered desirable, I would suggest the use of "R" (which naturally suggests rough). This "R" would be placed on the unfinished surface and when used it would be understood that all other surfaces were to be finished.

Rochester, N. Y. RALPH W. DAVIS.

## "Straightening Hardened Steel Punches"

On page 148 E. H. King gives your readers some interesting personal experi-




STRAIGHTENING HARDENED PUNCH IN VISE

ence in straightening work that has become crooked when hardening; which reminds me of a rather novel, although not new, method that I have often used with good results, for straightening drawing punches that have sprung in hardening.

This method, however, differs from Mr. King's as it involves the use of a vise as shown in the accompanying sketch, and does away with the necessity of tieing up a lathe to accomplish the same result. Where the punches are extra long a lathe must necessarily be used, but for the shorter ones the method herewith shown gives just as good results as a lathe.

The three pieces marked *A* are made of ¼-inch square tool steel, similar to that shown to the right of the sketch, and are hardened and drawn to a blue. The punch is placed in the vise with the bow side to the front and is heated with a bunsen burner until it becomes hot enough to make water sizzle when dropped thereon. The vise is then screwed up tighter so that the punch will slightly bow on the other side, and is then allowed to cool of its own accord. This operation is repeated if necessary.

Waterbury, Conn. CHAS. DOESCHER.

## Laying Out Angles without a Protractor

On page 742, Mr. Carlton gives a method of laying out angles without a protractor. This method is to lay off an arc of any desired radius and where the arc intersects any line drawn from the center, swing another arc whose radius is equal to the radius of the first arc times twice the sine of one-half the angle desired. This is the familiar formula for the chord of an angle and gives accurate results when used correctly, which Mr. Carlton fails to do. If we examine Fig. 1 in the article under discussion, we shall find that after laying off the two arcs, Mr. Carlton has drawn the side inclosing the angle as a tangent to the second arc instead of from the point where the two arcs intersect. Obviously, this construction gives a right-angle triangle and to get the correct radius for the second arc, using this construction, the radius of the larger arc should be multiplied by the sine of the desired angle, instead of twice the sine of one-half the angle, which is a simpler formula to use and to remember.

W. L. DURAND.

Washington, D. C.

[The error Mr. Durand calls attention to is obviously one which was made by the engraver, as Mr. Carlton distinctly refers to line *O C*, of his Fig. 1, as drawn through the point of intersection of the two arcs to inclose the angle.—ED.]

## Extracting Small Slivers

James F. Hobart, in his article on the above subject on page 796, refers to a small pocket magnifying glass. Some years ago I saw the folding glass, shown to the right in Fig. 1, and in the right eye in Fig. 2. I bought it and then my troubles began. The first time I used it

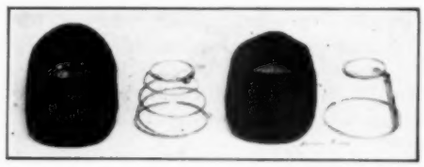


FIG. 1. TWO STYLES OF FOLDING EYEGLASSES

FIG. 2. FOLDING EYEGLASS USED WITH SPECTACLES ON

in a shop it was seized by the foreman toolmaker as contraband. I have since been kept busy buying these glasses only to have them taken away from me by the men in the shops.

To the left in Fig. 1 is shown a cheaper glass. Both of these glasses close up flat and when slipped in the leather case measure 2x1¾x¼ inch. They can be used without removing spectacles or eyeglasses, as shown in Fig. 2. They can be bought in various strengths from L. H. Keller & Co., 64 Nassau street, New York.

New York. E. A. DIXIE.

## Shrinking Holes in Dies

Reading the article on page 116 puts me in mind of the way I shrink dies, after the same are worn large. For instance, I take a die 4x4x¾ inch with a 1½-inch hole, or a ring die 3 inches in length, 3 inches diameter and 1½-inch hole, heat them to a nice red, place them on a small board, cover them with another small board and put a weight on the top. This will allow the boards to burn and smoke for a few moments, but will prevent the water from reaching the faces and holes of the dies. After this I turn on the water, letting it rise slowly.

In this manner I am able to cool the steel uniformly. This will shrink the holes from 0.010 to 0.030 in one heat, depending upon the kind of steel used. After shrinking they can be hardened in the usual way.

In hardening a long slender reamer or tap, I heat it carefully, and dip it straight down in fairly hot water, allowing it to remain submerged until the tool and water are of the same temperature. This does not permit of the tool getting entirely cold, and when I remove them from the bath, I find they are always straight, hard and true.

Kenosha, Wis. FRANK KUSTERLE.

## My Cost System and How It Worked

Mr. Platt's article at page 674 on "Unexpected Results from a Cost System," reminds me that I never have reported the results of my inquiry into some difficulties that I have met. My situation was like this: I was building, well, say 24-inch engine lathes, for the sake of a concrete illustration, in lots of 12. I was making most of the parts in lots of 12, but some of the smaller parts I made in lots of 24 or 48 and the larger parts like the beds, lead screws, etc., I made only as ordered. It would often be a matter of a year or more before an entire lot was completed and shipped. The question was, how to handle costs.

### THE STORE ROOM AND STORE KEEPER

I had several suggestions but none of them satisfactory, so we had to get up our own scheme, the keynote of which is a store room for materials, finished stores and work in process. Theoretically, all work is in the hands of the storekeeper except when it is being actually operated on, and no two operations should be performed without the job going back to the storekeeper. Practically, it is hard to find the store room but the storekeeper is very much in evidence. He is a young man just from Missouri and it is up to him to know just what has been done to every detail of work that is under the roof or out in the yard.

Our office books charge all materials brought in which are to be worked up into our product to "machine-shop stores, or wood-shop stores," etc. All labor is divided in the office into productive and nonproductive, the productive being charged to the shop where it is used. Our cost books must account for all material charged to machine-shop stores and all productive labor charged to machine shop. The detail of time keeping is not different from many that have been described. All time paid for must appear as the cost of something. We run an account for replacement and repair of

machinery, of small tools and replacement of spoiled work. Of course, when these accounts get back to the office they go in as overhead charges but to us they are just as much manufacturing accounts as 24-inch engine lathes.

This young Missourian keeps track of the work so as to know at all times

a. How many pieces were begun,

b. What operations have been performed on all,

c. How many have been spoiled,

d. How many spoilers have been replaced. In case certain operations have been done on only part of the pieces he knows.

e. How many are in his hands as storekeeper and what has been done to them,

f. What operations have been performed on the remainder that are going through the shop.

Nobody has to notify the store clerk of anything, but it is up to the storekeeper to know everything so everyone must answer his questions. He looks over the time cards every morning and goes to the workmen to get things straightened out. He makes sure that time is charged up *operation by operation* and that the operation which appears on the time card was actually performed.

### How the Costs Are Figured

When our lathe is done and we want to know what it cost we can tell by taking the proportionate cost of all parts which were carried through in dozen lots plus the cost of each operation on the parts carried through in less than dozen lots, which is the same thing as saying that the labor cost of the whole machine is the sum of the costs of each operation.

I do not know of any way that costs can be satisfactorily kept except to get down to individual operations, but I also believe in a flexibility in the method. For example there are many pieces of work that can be planed or milled. If every planer in the shop is rushed I believe in milling and *vice versa*. Many such cases can be cited. If operation sheets are used there is no chance for flexibility but here the method of doing work is left to the boss, and the storekeeper simply records as a matter of history what operation was performed. The next lot might have different operations or the order might be different, but when the work is done the result is the same. If the boss had a job planed and it cost more than milling and the storekeeper knew that it was planed to get it done in time to go along with the rest of the job, there is neither friction nor criticism.

The beauty of this scheme is that it does not interfere with the ingenuity of the individual foreman by prescribing hard and fast methods of procedure and yet it keeps absolute track of the work, provided, of course, that the storekeeper is faithful. Of that there is no reason for anxiety for if he is not faithful his records are sure to get in such a tangle that it would be easier for him to get another job than to straighten them out.

Worcester, Mass. C. H. Fish.

## Hydraulic Press Cylinders

I wish to call attention to what is evidently a misprint at page 579, of Professor Jenkin's article on "Design of Hydraulic Press Cylinders. The equation for Barlow's formula should read

$$\frac{S}{P}=\frac{r}{T}+1.$$

The equation from which this was evolved was right and his plotting of the results was right, so this is doubtless a printer's error.

particles will then be equal to the hoop tension plus $\frac{1}{m}$ times the radial pressure, where $\frac{1}{m}$ is Poisson's ratio between lengthwise and sideways deformation under direct pull, and we get a formula like this;

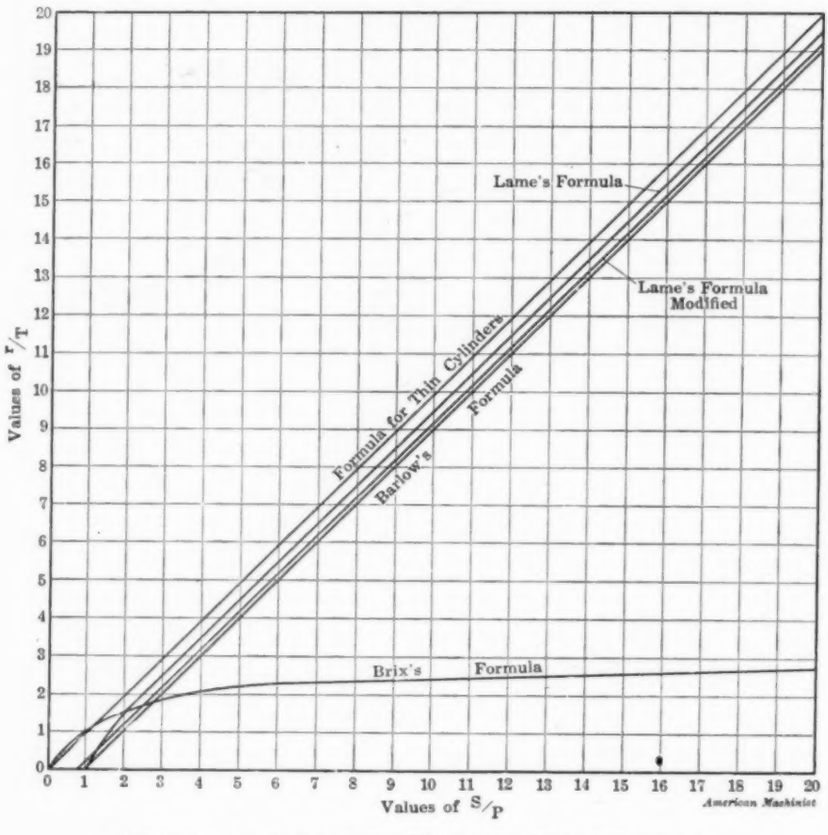
$$\frac{S}{P}=\frac{2r^2+1.3T^2+2.6Tr}{T^2+2Tr}.$$

When plotted, this is a straight line parallel to the others, coming close to Barlow's, and which might be expressed by

$$\frac{S}{P}=\frac{r}{T}+\frac{9}{10}.$$

This modification of Lane's rule is so close to Barlow's that the latter might as well be accepted as correct.

These results, of course, apply only when the elastic limit is not exceeded.




Relation of Formulas for Hydraulic Press Cylinders

It is also to be noted that Lame's formula can be rewritten from the curve, as;

$$\frac{S}{P}=\frac{r}{T}+\frac{1}{2}$$

which is much simpler to use and equally good.

Also, if in Lame's formula we take note of the fact that the particles in the inner layer of the tube are under compression at right angles to the line of tension, we observe that the effect of the compression is to elongate the particles in the same direction that the tension elongates them. The equivalent stress on the

If the material is cast iron, where the elastic limit is not clearly defined and where the stress-strain curve slopes off rapidly, the actual bursting point may not agree with what is expected. That is; if the tensile strength of the iron is 21,000, and the working or safe load for which the cylinder is designed is 3000, there is a factor of safety of 7. On the other hand, if the cylinder is actually burst, it very likely will not show a factor of more than 4 or 5, because of the change in the direction of the stress-strain curve for either tension or compression.

Springfield, Mass. Entropy.

# Fifteenth Annual Meeting Nat'l Association of Manufacturers

It has been our custom to report briefly the annual conventions of the National Association of Manufacturers in so far as the papers, the discussions and resolutions were of especial interest to the machine-building industry. This year's meeting, held on May 16, 17 and 18, is especially noteworthy in the history of the association.

As previously announced, one entire session was devoted to the problems of industrial accidents and industrial insurance. This brief report will be directed largely to the doings of that session, although the others will be taken up in order.

### In Memory of Ex-President Van Cleave

The death of Ex-President James W. Van Cleave, of St. Louis, on the day before the opening of the convention, was deeply felt by the entire membership. The first order of business was a resolution characterizing him as possessed of all the instincts of a patriotic nature, the courage of his convictions, the spirit of self-sacrifice and the highest of human ideals.

On the afternoon of Tuesday the regular order of business was suspended at the hour of the funeral in St. Louis, and a brief memorial service was conducted.

### Monday Afternoon Session

The Hon. Ormsby McHarg delivered an address on "Distribution of Immigrants a Necessity," in which he pointed out that the sources of our immigrants are very largely the country districts of Europe; that is, the immigrants themselves are farmers. When this country is reached but very few go into agricultural pursuits, the great majority find work and homes in our cities. As a result, the farmers of the entire country are in need of labor which they cannot get. It is impossible for one State to transfer any part of its population to another State, although the second State may be greatly in need of a class of labor represented by the aforesaid population. Therefore, as a general proposition, the National Government should undertake the work of directing immigrants to the sections where labor is needed, and encourage immigration to those sections.

The committee on immigration in its yearly report discussed at considerable length the alien contract labor law, and among others, presented these recommendations: "That the present law be amended so as to provide as follows:

"(*a*) That it shall be lawful to import skilled labor when the person importing cannot obtain laborers of a like kind in this country who will work for him at the rate of wages prevailing generally in this country for such labor. (*b*) That the Secretary of Commerce and Labor be authorized and directed upon the application of any employer and upon his showing the facts set forth under (*a*) above, to grant to such person the permission to import such labor, such permission to be conclusive upon his right to do so and upon the right of the aliens to land."

The question of fire prevention was brought forward in an address by Charles L. Case on "A View of Current Fire Prevention Policy from the Standpoint of Insurance Underwriters," and in the report of the committee on fire prevention. A formal recommendation was made that a central bureau be established for the prevention of fire waste.

The committee on Interstate Commerce set forth the necessity of a deep-water communication between the Great Lakes and New York harbor by way of the Hudson river and deep-water canals. This, as an incidental, brought in the commercial relations between the United States and Canada, and we are pleased to quote: "A growing number of our citizens will heartily favor a more liberal policy and a more courteous attitude toward our neighbors across the border, because we thus advance our interests as much as theirs."

### Tuesday Morning Session

President Kirby, in his presidential address, referred to the past year as one that had been much less arduous for the officers of the association than many years that had preceded. He advised the members to pay the Federal Corporation tax under protest, because of the doubt that exists as to whether or not the corporation tax law is constitutional. In closing, he outlined the needs and work of the association and suggested that the time had come when a permanent foundation or endowment seemed advisable.

James A. Emery sketched the trend of legislation, dealing particularly with industrial affairs, and then devoted considerable time to a discussion of the legislative tendencies in regard to industrial accidents and insurance. He pointed out that our present laws prevent the compensation for industrial accidents being fixed at all on humanitarian grounds. The employer does not deal directly with his employee and the injured workman must apply to an outside concern established and run to make as large profits as possible. The result is embitterment long before a settlement of any kind is reached.

### Tuesday Afternoon Session

The report of the Committee on Patents referred to its report of a year ago and the recommendation therein contained that our Government arrange for treaties with the leading foreign nations to the end that American inventors may receive more liberal treatment in patent relations and be relieved of the working requirements now prescribed in many such countries. The progress during the last year is thus summarized:

"Since the date of the last convention, the negotiations between the representatives of the United States and those of foreign countries have resulted in a treaty with Germany under the terms of which the working of a patent to protect its validity in that country is no longer required.

"Similar treaties are under negotiation and likely to be concluded with many leading foreign commercial nations, which will undoubtedly bring relief to American inventors from the onerous working laws complained of if this country continues to retain its present liberal system."

Pending patent legislation was reviewed in detail, and approval expressed of bills now before Congress, providing a means for recovering reasonable compensation on the part of the owner of any patent, provided the invention covered by the patent had been used by the United States without license.

The speedy passing of Senate Bill 4982 and House Bill 14,622 are urged in this resolution:

*Whereas*: The procedure in patent legislation as at present conducted with nine Courts of Appeal with equal authority but with separate jurisdiction, involving the necessity for many independent suits in the same matter, with excessive technical testimony and voluminous records, frequently followed by diametrically opposed final decisions in the different jurisdictions, is an intolerable burden to the owner of patents and to manufacturers, regardless of which side of the litigation they may be upon.

*And whereas;* a bill is now pending before the present Congress providing for the establishment of a Court of Appeals to sit at Washington and hear appeals in patent suits from the nine United States Circuit Courts throughout the country

*And whereas;* it is believed that the establishment of such a tribunal will operate to expedite the consideration of such causes, insure a greater degree of uniformity in decisions on patent questions and obviate the liability that now exists under the present system of procedure of a patent being sustained and held operative in one or more Circuit Courts and held to be inoperative in other circuits.

*And whereas;* it is desirable that the

interminable delays in the adjudication of such causes should be avoided and that a patent should have the same effect and application throughout the United States,

*Be it resolved*: That the National Association of Manufacturers give the pending measures, Senate Bill 4982 and House of Representatives Bill 14,622, its approval and urge upon Congress the speedy enacting of these measures for the creation of such Court of Appeals.

In regard to reducing the length of time between the motions on a patent application, the report advises against such a course, but does suggest that a limit be placed upon the length of time that a patent should be in force, dated from the date of application. We quote: "Except where an interference contest occurs, a delay of three years would seem ample in substantially all cases, and your committee, therefore, suggests that the association should recommend to Congress that it shall be provided that commencing, say one year after passage of the act, no patent granted should remain in force after the expiration of 20 years from the date of the application therefor, except where the grant of a patent was delayed by interference proceedings, in which case the commissioner may determine the extent of such delay, which is not due to the act of the applicant, and add the period thus determined to said 20 years, provided that in no case should the patent remain in force longer than 17 years.

### Prevention of Industrial Accidents

The opening of the subject of industrial accidents and indemnity insurance was given to Professor Hutton, who spoke on the subject, "The Prevention of Industrial Accidents," and on behalf of the American Museum of Safety. The following classification of accidents was given:

First, the nonpreventable class:

1. Breakage of good material under service.
2. Breakage of material from a fault revealed.
3. Failure of the workman to respond to some emergency.
4. Slackness from a lowered vitality.
5. Pure carelessness or negligence.
6. Mistaken bravado, or "freshness."

Second, the preventable accidents:

1. By mechanical safety devices and apparatus.
2. By inspection and superintendence to see that these are used.
3. By keeping up the bodily and mental health of the worker.

Professor Hutton urged that the association and its members support the American Museum of Safety and aid in its growth and work, showed a number of lantern slides of the museums of Europe, the work that is done there, devices that have been introduced in factories of this country, and summed up the cost of industrial accidents under three headings.

What does it cost you to have an accident?

1. The loss in production for the time of his disablement of the man hurt. If he is not easily replaced there is a dead loss of $2.50 a day in losing this factor as a producing agent.
2. His machine is idle for so many days, while interest and overhead charges run on.
3. His accident demoralizes the room where it happened at least for a day; possibly for a week.
4. A new man has to be trained, and he is slow getting his gait.
5. The time of the foreman in coaching him.
6. The accident premium.
7. The liability premium.

The second waste is the economic loss:

1. He is a charge on a mutual benefit fund; or
2. He is a charge on the poor fund because he is withdrawn from the wage-earning class.
3. His litigation is a cost paid by the tax payers as well as the costs of the suit.
4. His care in the hospital is a community loss.
5. His dependents are a drain on the community.
6. His support in old age, with no savings to draw upon.

The third is the humanitarian argument:

1. His pain.
2. The sorrow to his people.
3. The addition to the misery of the world.

The second speaker was Henry L. Rosenfeld. His argument was for coöperation and compensation, as opposed to compulsion and compromise in employers' liabilities, leading to this conclusion: "The conclusion is inevitable that the present premium rates for employers' liability insurance are sufficient to provide for participation in profits, while the indemnity furnished has been on a nonparticipating basis so far as the policy-holder is concerned." Following this conclusion comes the suggestion: "We now come to the coöperative company having charter capital but working on a special plan—a system combining the advantages of mutual office with those of the proprietary. A stock company with sufficient capital to insure absolute solvency, and a fulfilment of every contract, based upon the mutual principle in administration of the business and a distribution of the profits, is the ideal middle ground between the corporate company, organized purely for gain, and the mutual company. In a company of this sort, the profits, as made by the proprietary management are to be divided between the policy holders and the stockholders, on a fair basis. A fair average working basis as a start would be 80 per cent. for the policy holders and 20 per cent. to the stockholders. The exact basis of division of profits is minor and unimportant at the outset. It is the principle which is essential."

In an interesting address, Miles M. Dawson touched upon the objection that is made to any scheme of compensation because legislative action is supposed to be restricted to the States and is impossible on constitutional grounds by the Federal Government. Mr. Dawson gave as his matured opinion that no constitutional bar would be found to Federal action.

### Report of Committee on Industrial Indemnity Insurance

Probably the most authoritative investigation that has ever been made of the subject of prevention of accidents and workmen's compensation in this country is summed up in the report of this committee. It represents an enormous amount of labor, the results of investigations along many lines, a digest of the opinions of the membership of the association which now is about 3000 firms, employing upward of 1,400,000 workmen, and sums up its conclusions in a carefully drawn set of resolutions, given below in full.

The report and its appendices cover 114 printed pages, and it is clearly impossible to treat of it here, even in abstract. We earnestly recommend the study of this report on the part of anyone who is interested in these subjects.

### Resolutions of Committee on Industrial Indemnity Insurance

*Whereas*: The National Association of Manufacturers occupies a leading position in all instructive work for industrial betterment, and particularly for harmonious relations between American employers and wage workers, and

*Whereas*: The United States is admittedly less advanced than the progressive European nations in respect to employers' liability and industrial accident indemnity, to the detriment of the nation, its institutions and its people,

Now, therefore, the National Association of Manufacturers in behalf of humanity, good citizenship, national reputation and industrial progress, resolves:

First, that the present system of determining employers' liability is unsatisfactory, wasteful, slow in operation and antagonistic to harmonious relations between employers and wage workers.

Second, that an equitable voluntarily mutually contributory indemnity system,

automatically providing indemnity for victims of industrial accidents, and their dependents, is required to reduce waste, litigation and friction and to meet other requirements of an enlightened industrial nation.

Third, that to that end it is our desire to coöperate with State legislators in promoting uniform, sound, industrial indemnity legislation and our duty to oppose unsound legislation.

Fourth, that we recommend to our members the inauguration with the least possible delay of a system of voluntary, mutually contributory industrial accident indemnity insurance, this system to be elastic enough to provide for voluntary contributory sickness, old age and death insurance, if later deemed advisable.

Fifth, that the president and directors of the National Association of Manufacturers are hereby authorized to arrange for the establishment of such a mutually contributory insurance plan with the definite understanding that the National Association of Manufacturers assumes no financial responsibility in connection therewith.

Sixth, that a department on prevention of industrial accidents be established by the National Association of Manufacturers, either independently or in conjunction with others, for the gathering of statistics, the study and exhibition of preventive devices, for coöperation with State and national inspection department, and for the promotion of the better understanding of the whole subject.

Seventh, the prevention of accidents being of the utmost importance, we authorize the president of the National Association of Manufacturers to offer substantial money prizes for the safest plants or the best safety devices brought to his attention each year, and we urge manufacturers to offer other prizes through the medium of this association to stimulate invention of safety devices and the broad study of the subject, so that, in this direction, as in others, the United States may soon become the leading industrial nation of the world.

### Supplemental Resolutions of the Committee on Industrial Indemnity Insurance

*Whereas*: Compulsory provisions by State or Federal legislation for sickness and old age relief (occupational diseases excepted) of wage workers, by either employer or employees or by coöperation of the two, would be a departure from accepted doctrines, contrary to American ideas and detrimental to thrift and economy.

Now, therefore, be it resolved, first, that the National Association of Manufacturers approve such voluntary sickness and old age relief in private employment and authorizes its officers to encourage it by all reasonable means.

Second, that it disapproves such compulsory sickness old age relief in private employment, and authorizes its officers to oppose it by all reasonable means.

Third, that it urges the president and board of directors to appoint a new committee to deal with these subjects in a comprehensive and systematic fashion. It urges the new committee to gather additional information, home and abroad, with a view of aiding members in establishing individual relief systems or establishing mutual or other suitable insurance. Schemes for dealing with these problems are in process of constant development and it should be made possible through our association's efforts, for our members to become and remain thoroughly informed.

### Wednesday Sessions

The Wednesday sessions were devoted largely to the reports of committees and routine business. The Hon. E. B. Vreeland gave the only address of the business session, speaking from "How Shall We Reform Our Banking and Currency System?"

The officers of the association were reelected, John Kirby, Jr., thus beginning his second year of the presidency.

The usual well attended reception and banquet in the evening, with several prominent men as speakers, closed the convention.

# Ductile Tungsten and Molybdenum

*By Colin G. Fink*

Tungsten has heretofore been known chiefly as a steel-hardening metal. In recent years it has become an important material for filaments of incandescent lamps and is today the most efficient metal for this purpose. This is owing to its high melting point of 3000 degrees, which is higher than that of any other metal, and its low vapor tension.

Tungsten is described in all of the text books as a brittle, gray metal. Numerous attempts have been made to make it ductile, as is evidenced by publications emanating from various research laboratories. Roscoe and Schorlemmer, in the latest edition of their "Treatise on Chemistry" state that "the porous forms of tungsten at present obtainable are hard and brittle and are not ductile either at ordinary temperatures or when heated."

The metal has ordinarily been obtainable in commerce in the form of a dark-gray powder, usually made by the reduction by hydrogen or carbon, of a yellow oxide. This powder, when bought on the open market, is generally impure, and is purified by various well known methods, particularly if the metal is to be used for filaments of incandescent lamps.

Attempts have hitherto been made to produce ductile tungsten by various purification processes, and all without success. Incandescent-lamp filaments have been made of tungsten in large quantities and are in common use in this country and abroad. Even in ordinary commercial lamps, the filaments are of a degree of purity so high that no impurities can be discovered by the most searching methods known to chemical analysis. These filaments during the course of commercial production, are exposed to temperatures high enough to drive out by mere vaporization almost any conceivable impurities.

Nevertheless, these filaments show no traces whatever of ductility or even pliability, and though they are strong enough for mounting in commercial lamps, they are exceedingly brittle and incapable of taking a permanent set.

Attempts to produce ductility have been made by varying the ore from which the tungsten is obtained, as by trying first wolframite, an iron manganese tungstate, and then scheelite, the calcium tungstate. Whichever ore is used, it is customary to produce from it the yellow oxide, and a high degree of purity has been sought by repeated precipitations. Various methods of reduction have been tried; among other reducing agents used have been hydrogen, carbon, aluminum, zinc and magnesia. Reduction has also been effected by electrolytic methods.

Since tungsten metal produced in these ways has been so pure that no impurities could be detected by ordinary chemical or physical means and yet it has retained its characteristic hardness and brittleness, it has generally been concluded that the metal is entirely lacking of that physical property that is ordinarily termed ductility.

Announcement has, however, recently been made of the production of tungsten in a form that is ductile, and this ductile tungsten would seem to be a new substance, from the point of view of the physical chemist. Therefore, it seemed to us that this society would be interested in learning something of the properties of this product, since only those of us who have been connected with the Research Laboratory of the General Electric Company have as yet had an opportunity to study it.

*A paper read at the seventeenth general meeting of the American Electrochemical Society, Pittsburg, May 4, 1910.

Ductile tungsten is a bright, tough, steel-colored metal, which can be drawn into the finest wire, that is, much below one-thousandth of an inch. The tensile strength of the wire increases as the drawing proceeds, or, in other words, the more the metal is mechanically worked, the tougher it gets. In the following table a few figures of the strength of tungsten wires are given. They are the averages obtained from a large number of measurements.

| | Tungsten. | Molybdenum. |
|---|---|---|
| Diameter in Parts of an Inch. | Pounds per Square Inch. | Pounds per Square Inch. |
| 0.0005 | 460,000 | 200,000 |
| 0.0005 | 490,000 | 260,000 |
| 0.00028 | 480,000 | 230,000 |
| 0.00028 | 530,000 | 270,000 |
| 0.00015 | 550,000 | 270,000 |
| 0.00015 | 600,000 | 310,000 |
| 0.00012 | 580,000 | ..... |
| 0.00012 | 610,000 | ..... |

TABLE 1. TENSILE STRENGTH OF DUCTILE TUNGSTEN AND MOLYBDENUM WIRE.

A piece of hard-drawn piano wire, tested with the same apparatus, registered, on the average, 507,000 pounds, the diameter of the wire being 0.0003 of an inch. According to Schnabel, aluminum shows a similar behavior as regards the effect of drawing. Cast aluminum shows about 17,000 pounds per square inch, whereas the drawn metal has a tensile strength of 36,000 to 39,000 pounds.

The density or specific gravity values of ductile tungsten likewise increase with the amount of working. The values for ductile molybdenum were also determined at our laboratory. The results obtained were as follows:

| Before Drawing. | | |
|---|---|---|
| Diameter in Inches. | Tungsten. | Molybdenum. |
| | 18.81 | 10.02 |
| **After Drawing.** | | |
| 0.150 | 19.30 and 19.30 | 10.04 |
| 0.010 | 19.58 and 19.64 | 10.29 |
| 0.0015 | 19.86 and 20.19 | 10.32 |

TABLE 2. SPECIFIC GRAVITY OF DUCTILE WIRE.

Martin (1907) found the density of melted tungsten analyzing 98.96 per cent. pure, to be 16.28; Moissan (1896) and Weiss (1910) give the values as 18.70 and 18.72 for the brittle metal. As is seen from the table, the density increases very appreciably with the amount of mechanical working applied. This same phenomenon is well known in the case of copper, zinc and other metals. The density of cast copper, according to Marchand and Scheerer, is 8.92, and that of rolled and hammered copper, 9.95. Distilled zinc measures 6.92, and wrought zinc, 7.25.

The electrical resistance and the temperature coëfficient of each of the two metals are given in table 3. We used the Wheatstone bridge method. The resistance was measured at room temperature and at 170 degrees, employing two oil thermostats.

The values marked *d* are for hard-drawn wire; those marked *a* were obtained after annealing. These resistivity values are a good deal lower than those given by Gin (Trans. Am. Electrochem. Soc. XIII, 483; XII ——) the coëfficient for copper (0 degrees — 160 degrees) is 0.00445 (Reichardt).

| Resistivity (25°) in Microhms per Cu. Cm. | Temp. Coef. Between 0° and 170° C. |
|---|---|
| Tungsten d. 6.2 | 0.0051 |
| Molybdenum d. 5.6 | 0.0050 |
| a. 4.8 | ..... |

TABLE 3.

The hardness of both tungsten and molybdenum depend very much upon the amount of mechanical working the metals have been subjected to and upon the presence of impurities.

Chemically, the two ductile metals behave similarly in many respects. The drawn wire retains its luster almost indefinitely. Both metals are readily attacked by fused oxidizing salts, such as $NaNO_3$, $KHSO_4$ and $Na_2O_2$. Acids (HCl, $HNO_3$, $H_2SO_4$) attack tungsten very slowly, but molybdenum rather readily. I have heated fine-drawn tungsten wire in a mixture of chromic and sulphuric acids for 16 hours and could detect only a very small loss in weight.

Original weight: 16.7330 grams; after 16 hours, 16.7329 grams
Original weight: 1.3638 grams; after 14 hours, 1.3635 grams

Apparently the metal becomes passive just like iron.

This work was carried out at the Research Laboratory of the General Electric Company, at Schenectady, N. Y. Naturally a number of chemists and research men have been active in it, foremost among whom is Doctor Coolidge.

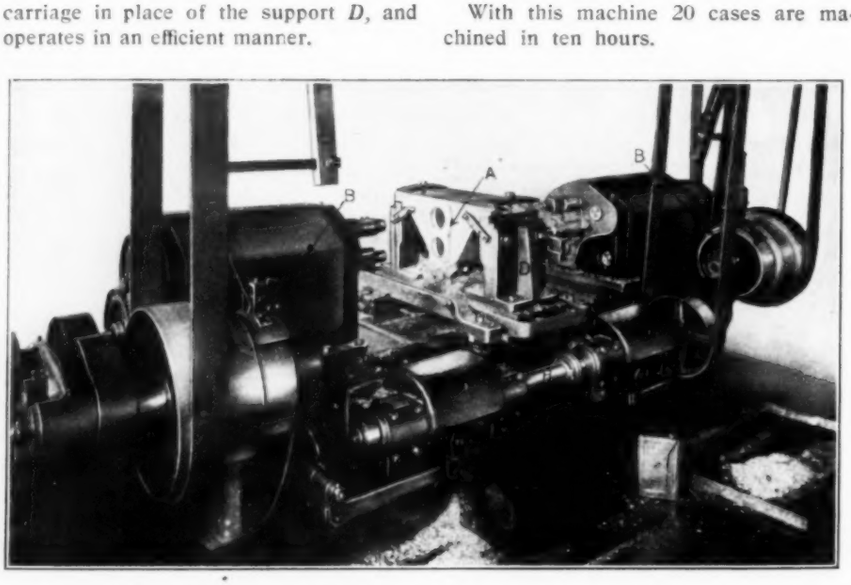
# A 10-spindle Horizontal Boring and Drilling Machine

The halftone shows a 10-spindle horizontal boring and drilling machine, which was recently built by Beaman & Smith, of Providence, R. I., for the Brown-Lipe Gear Company, Syracuse, N. Y.

At *A* is shown one of the transmission cases in place on the machine. These cases are made rights and lefts and each case has at least 5 holes, two large ones at each end and one small one for the shifter rod at one end. Others of the cases have a hole at the side for making which an attachment was built. Besides the automatic stops for the carriage there is a very neat brake arrangement which is coupled to the shifter rods *C*.

The friction brakes *B*, on the driving pulley, are forced on to the pulleys by the action of throwing the countershaft belts onto the loose pulleys and lifted off them on throwing the belts on to the tight pulleys. The attachment for boring and facing a flange on the side of one type of transmission case is fastened to the carriage in place of the support *D*, and operates in an efficient manner.

With this machine 20 cases are machined in ten hours.




A Ten-spindle Horizontal Boring and Drilling Machine

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American Machinist

# Editorial

## The Trend Toward Simpler Machine Tools

As has been remarked before in these columns, fashions are not confined to women's bonnets or to the latest style of high-heeled shoes.

When the single-pulley drive for machine tools began to be popular, buyers began to demand it on everything and often refused to buy a cone-driven machine simply because it was not up to date, in their eyes.

This naturally led to the gear-drive idea being extended to a large variety of machines for which it was not adapted and with the usual result. Geared machines were bought for work which did not require them. The increased first cost and the inevitable higher maintenance which accompanies added parts, both have their effect, and the reaction seems to have begun.

No one disputes that there is a field for the all-geared machines but many who build types are advocating the cone-driven machines for a large class of work where they do not believe the work demands the extra cost of the other type.

The geared feed seems to hold its own where more than three or four changes are considered necessary and considerable ingenuity is being exercised to simplify feed-gear boxes.

In a word, the trend of machine building seems to be toward simpler and single-purpose tools, which is in the right direction.

## Manufacturing Colonies and Homes for Workmen

The growth and congestion of large cities, with the ever increasing land values and taxes, are forcing many manufacturing establishments to move out to the suburbs or even to the establishment of colonies of their own.

These have many advantages. They afford ample room for growth, the possibilities of air and light are well worth considering and most men appreciate a breathing space for their families if not for themselves. The housing of the workmen, however, sometimes presents quite a serious problem. There are serious objections to the mixing of manufacturing and the renting of houses, as the company house is not altogether attractive to the average workmen.

On the other hand, this is often the only way to handle the problem and keep out the land speculator, who can do more to throttle the development of a new manufacturing community than any one thing we know of. Several instances come to mind where the land around new factories has been promptly grabbed by a land company, and prices raised to the point where it is cheaper to live in the city several miles away.

This makes it difficult to secure good men steadily as they naturally prefer to work nearer their homes or live nearer their work. And a floating shop force is not desirable in any way.

It seems desirable from every point of view to prevent this speculation and get the land into the hands of as many small holders as possible. This may necessitate the manufacturer temporarily going into the real-estate business, but it will pay him in the long run to forego excessive profits on the land in order to give an opportunity for good workmen to live reasonably at a convenient distance from the shop.

## The Vacation

As the summer season approaches, we notice the change in the attitude of men toward vacations. Not long ago men boasted that they had never had a vacation; now, except for a remaining few of the older generation, everybody takes more or less of a breathing spell.

What are we to suppose that the new order of things means? Is it a sign of decay? of approaching laziness? of too much wealth? We think not, but rather that it is a sign that we are repudiating the old story of the hare and the tortoise. We feel today that we prefer to work with all our hearts and souls while we work, and play while we play. The pace which we set today with our telephones, wireless telegraphs, automobiles and limited expresses, is not to be compared with the leisurely methods of our ancestors, every day of whose work seems to us like a vacation when judged from our standard. It is an exceptional man who can go through year after year of rush

and scurry and bustle without breaking down, to say nothing about keeping himself fresh for the fray.

And here is the real heart of the movement; to keep oneself keen and active with the mind able to grasp new conditions as they come along. If the tale could be told of the number of failures in business that have been brought about by the heads of concerns staying at their desks and worrying about things when they ought to have gone out into the fields and onto the ocean, it would be as long as the list of those who have failed through neglect of business duties.

Having decided to take a vacation, let us be careful that we do not make too much of a business of our play. If we go fishing, let us cut a pole by the side of the pond and dig a worm or two for bait, instead of hiring a launch, inviting our friends and making a business of cleaning out the lake with scientifically selected flies and reels.

We remember an old gentleman, now gathered to his fathers, who weathered 60 years of financial worries with their attendant panics. He had a reputation for never taking a vacation, but when things were thick he would stay at home a week or two at a time and rake hay, or build a shed, or shingle a barn with his own hands.

This brings us to another point, and that is the question of long or short vacations. Years ago, 10 days or two weeks in July or August was considered the proper and only vacation. Now the tendency among professional men is to take a few days' fishing in the spring, a few days' run on the ocean, or at the seashore in the summer, a few days' shooting in the autumn, and a few days in Atlantic City or Bermuda, or Hot Springs in the winter. We believe that this is a good method for manufacturers as well; it does not break into the continuity of business operations and yet it gives frequent opportunities for brushing the cobwebs from the brain. As for the employee, what is sauce for the goose is sauce for the gander.

## Patent Legislation

On page 421 we called attention to certain pending patent legislation, and urged the passing of the bills to create a United States Court of Patent Appeals and to eliminate one of the appeals within the Patent Office itself.

At the recent convention of the National Association of Manufacturers, reported in this issue, their committee strongly urged, among other things, that pressure be brought to bear upon Congress to pass these bills at the present session.

We take advantage of this opportunity to again urge upon all readers who are interested in stimulating real invention and patent reform, to help the cause by writing to their representatives in Congress, urging the passage of these bills.

We also take advantage of this opportunity to express our approval of a suggestion made by the committee on patents of the association in that no patent shall be issued to be enforced for a period longer than 20 years from the date of filing the application, unless the prosecuting of that application has been delayed by interference proceedings. The aim of this suggestion is to do away with the abuse of the privilege of amendment, whereby an application may be held in the office for years before the patent thereon is issued, in effect extending the life of the patent.

An alternative suggestion frequently made is that the length of time allowed an applicant in which to make amendments be reduced from its present period of one year to a shorter period of say, six months. There are doubtless many valid objections to such a change. On the other hand, we see no objections whatever to limiting the term of a patent to a certain number of years from the date of filing the application.

## OBITUARY

J. W. Van Cleave, ex-president of the National Association of Manufacturers, died at his home in St. Louis, Mo., on May 15, after a brief illness thought to have been brought on by the high pressure he was working under during the past few years in connection with labor disputes.

Mr. Van Cleave served two terms as president of the National Association of Manufacturers. He was born in Kentucky in 1849 and when still a young man entered the stove-manufacturing business, and later became president of the Bucks Stove and Range Company, St. Louis, Mo., which position he held at the time of his death.

## NEW PUBLICATIONS

FOUNDRY NEWS. May, 1910, Volume 1, No. 1, 40 9x18-inch pages. Published monthly by the Foundry News Company, 50 Church street, New York City. Price $2 per year.

This is another journal in a field that is already ably and fully covered, yet as a product of technical journalism this first issue is not displeasing. There is a larger number of contributed articles than one might expect in a first number, and among the contributors we recognize the names of several who are well known as writers on foundry subjects. In addition to the general articles, ten definite departments are inaugurated with the following titles: Legal Decisions for Foundrymen, Current Foundry Literature, Mixing and Melting, Questions and Answers, New Catalogs, Foundrymen's Meetings, Personals, Foundry Equipment, Foreign Trade Opportunities, Foundry Trade Gossip. Although some of them are far from extensive, the question is at once raised, can such departments be carried on month by month and contain nothing but virile uptodate information? The absence of an editorial page and the usual "debutante bow" can be taken as an advantage or otherwise as the reader chooses. The cover design is plain, yet pleasing, the type larger than is probably necessary, and more illustrations might have been used to advantage, thereby making the pages more attractive.

## PERSONALS

*Items For This Column Are Solicited*

A. J. Baker, in charge of the tool-designing department of the Cincinnati Milling Machine Company, and frequent contributor to these columns, sailed on May 25 for a 6 weeks' trip to England.

A. T. Atherton, a designer of textile machinery, has become connected with the Rhode Island Elevator and Machine Company, of Providence, R. I., and will design a line of textile machinery for them.

Prof. Ira H. Woolson, of the civil-engineering department of Columbia University, severs that connection at the end of this school year in order to join the engineering staff of the National Board of Fire Underwriters.

Bert L. Ewens, for some time past with the Streator Motor Car Company, Streator, Ill., as factory superintendent, has resigned that position to accept the superintendency of the Sterling Electric Company, La Fayette, Ind.

Henry Morris, manager and treasurer of the Western Tool and Manufacturing Company, Springfield, Ohio, has returned from a European trip during which he made agency arrangements with a number of firms on the Continent.

L. J. Hoover, until recently president and general manager of the Grant-Hoover Ball Company, Merchantville, N. J., has made arrangements to represent in this country, with offices in Philadelphia, a large European steel-ball manufacturing plant.

Herman Winger, who for the past eleven years has been manager of Alfred H. Schütte's Italian branches at Milano, Turin, Genoa and Rome, has retired from that position. Mr. Winger has been very successful in introducing American machinery to Italian manufacturers, particularly those in the automobile field.

# New Tools and Machine Shop Appliances

**Showing New Ideas in Machine Shop Equipment That Make It Possible To Do Better Work at a Reduced Cost**

*ANY new or improved machine or shop appliance of interest to our readers will be illustrated and described in this department.*

*A full and more detailed description will be given—when of special interest and it appears here before being sent elsewhere.*

*ALL descriptions appear in all four editions of the paper—Weekly, Monthly, Weekly English and Weekly German.*

## Auxiliary Planing Head

The auxiliary or floor-planing head illustrated herewith, has been designed to handle work usually done on the open-side planer and has several interesting features.

First is a substantial floor plate with T slots and special T nuts, well grouted in concrete mud allowing the head to be located at the desired distance from the planer table. The base of the column is 30x42 inches and tall enough to allow the head to travel 42 inches above the planer table.

The tool head has a swiveling harp as well as a swinging clapper box and moves in the face of the column. This face is separate from the column itself and is pivoted in the center so that it can be swung around to bring the cutting point of the planer tool either side of the column. This makes the planer head perfectly adapted to either the right or left hand of the planer and can be transferred at will.

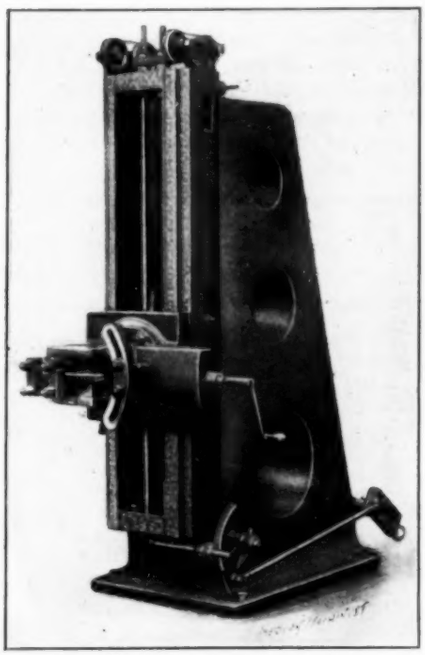


FIG. 1. CINCINNATI FLOOR HEAD PLANER

This also permits the face or ways carrying the tool head, to be adjusted perfectly square with the planer table at any time; a right- and left-hand screw at the top of the column making this simple and easy.

The power feed comes from the double combination friction used on the planer itself, this being transferred by rods made of seamless steel tubing, to a cross shaft at the base of the column, and from this to the vertical feed rods shown, through a new style trigger gear which is very compact and convenient for the operator. Both feeds are controlled by the small lever at the top of the tool head.

The amount of feed is regulated by the slot head on the end of cross shaft.

Micrometer dials are provided on all feed screws as on the planer itself. This is made by the Cincinnati Planer Company, Cincinnati, Ohio.

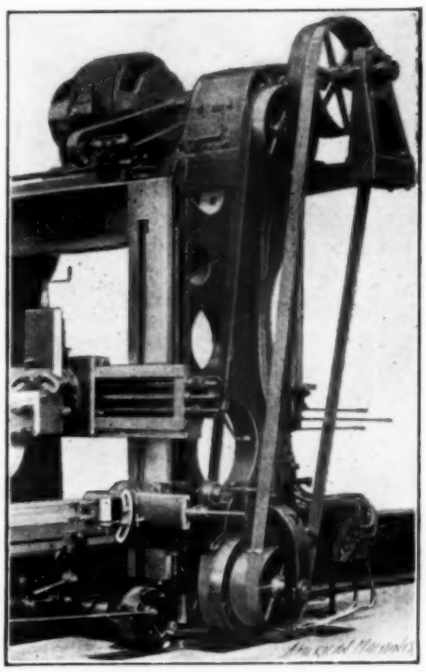


FIG. 2. SHOWING CONNECTIONS TO FLOOR HEAD

## Turret Tool Post

The Lodge & Shipley Machine Tool Company, Cincinnati, Ohio, has recently designed a new turret tool post made of steel, illustrated in the accompanying

TURRET TOOL POST

halftone. This turret tool post is made for each size of Lodge & Shipley lathe and on jobs where the parts manufactured permit the use of several tools should be a time saver.

The principal features of this new design are that the tools can be set diagonally as well as square with the cross slide, thus giving eight positions of the turret; that each tool is clamped well forward of the center so as to give firm support; and that the clamping of the binder lever does not appreciably change the position of the tool.

The lower block of this attachment is interchangeable with the compound rest slide and is fitted to the carriage dove tail by taper gib. A vertical stud is secured in this base and passes up through the turret to carry the binder lever at its top.

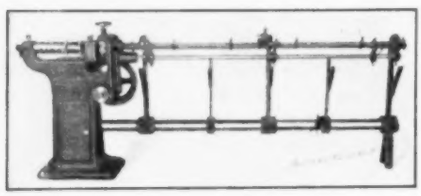
Each one of the four tools rests upon a serrated and hardened bolster or rocker, against which it is held by two hardened cap screws. By rocking the bolster in its curved seat adjustment in the hight of the point of the tool can be made. When the screws are tightened, the position of the tool cannot change.

The turret is exactly located in any one of the eight positions by a locking bolt dropping into notches in an index ring. The locking bolt is withdrawn by the handle at the front of the lower block. Take-up for the bearing of the locking

bolt is provided by a taper gib. A coil spring holds the locking bolt against the index ring so that it will at once drop into the notch when the proper point is reached. A screw shown in the illustration just beneath the end of the locking bolt provides adjustment for tension of this coil spring.

## A Wire Straightening and Cutting-off Machine

The halftone shows a machine for the above purpose made by the Charles



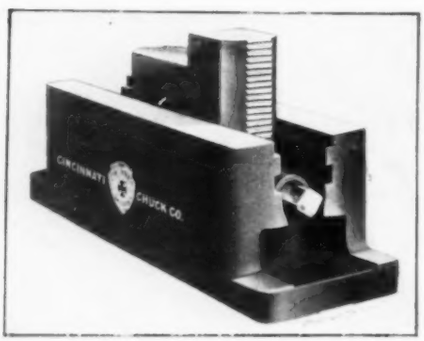
A WIRE STRAIGHTENING AND CUTTING-OFF MACHINE

Greiner Company, New Haven, Conn. These machines are built in various sizes for handling wire from 1/16 to ¾ inch diameter. They will cut the wire to any desired length.

## Face Plate Jaw

The chief feature of this face-plate jaw is the method of mounting the screws in hardened-steel bushings. These bushings provide a full bearing for the trunnions of the screws and receive the end thrust on their hardened full circular faces, designed to minimize wear and the resultant end play. When end play does develop, it can be taken out by the operator in a short time. The bushings hold the screws in line with the jaw, preventing any tilting of the screw and consequent cutting of the threads.

These jaws are a recent product of the Cincinnati Chuck Company, Cincinnati, Ohio.



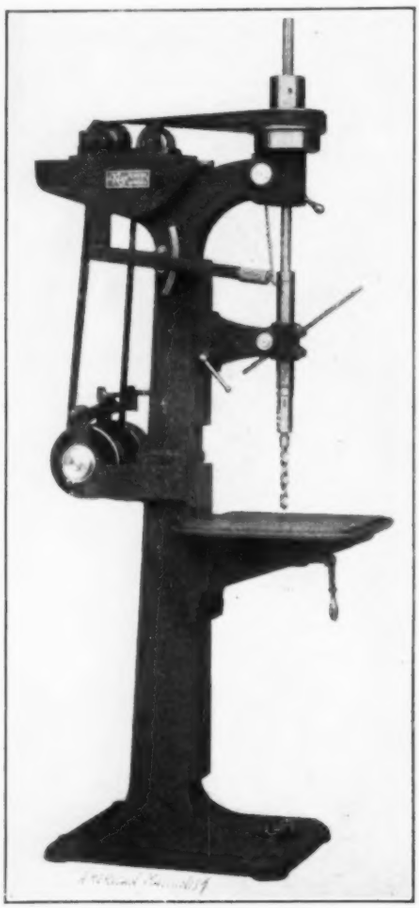

FACE-PLATE JAW

## High Speed Ball Bearing Sensitive Drill

This high-speed ball-bearing sensitive drill is a new model brought out by the Kern Machine Tool Company, Cincinnati, Ohio. It is much heavier and more powerful than former models, and is designed for hard service.

The machine is ball bearing throughout, all cones and ball races being of steel, hardened and accurately ground on special machines.

The lever at the left of the column controls the idler carriage. A slight downward pull loosens the belt and allows speed changes to be instantly made.



HIGH-SPEED SENSITIVE DRILL

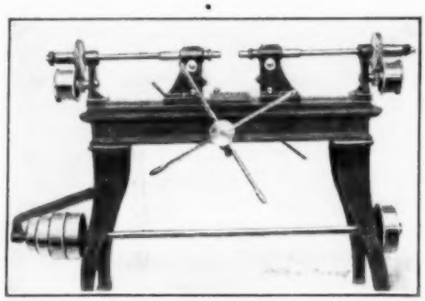
An upward pull of the lever tightens the belt to any required tension, and automatically locks the idler carriage.

The spindle cone is carried on a sleeve journaled in the column and relieves the spindle of any belt pull. This sleeve also raises and lowers the cone by means of a rack and pinion, operated by small lever. The spindle is double splined, and spindle sleeve is graduated and fitted with adjustable stop collar.

These drills are made in multiple type from 1 to 6 spindles.

## Double Head Traverse Drill

The halftone illustrates a new double-head traverse drill manufactured by the National Machine Company, Hartford, Conn. This double-head drill differs from their old model in that the new machine has hand feed instead of automatic feed. The four-armed handwheel in front of the machine controls both spindles, feeding them forward at equal speeds. The heads are adjustable along the bed so as to give a maximum distance between spindles of 20 inches. Suitable arrangements are made so that the handwheel controls the spindles at all



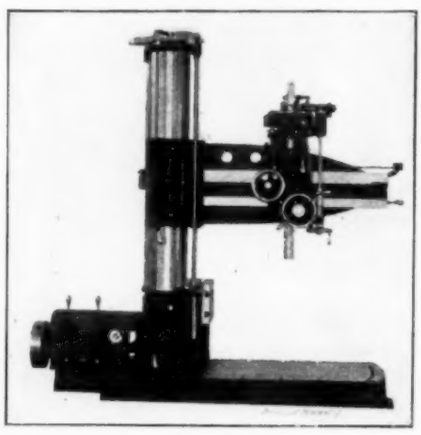
DOUBLE-HEAD TRAVERSE DRILL

positions, these positions also being independent of each other.

Spindles are made with No. 1 Morse taper and the machine is suitable for drilling up to 9/16 inch diameter. Spindles have a travel through the head of 5⅜ inches. Distance between center of spindle and bed is 7 inches and an adjustable plate 1 inch thick is also furnished. Countershaft with three-step cone pulley and tight and loose pulleys is furnished with machine.

## Improved Mueller Radial Drill

The illustration shows a new design radial drill brought out by the Mueller Machine Tool Company, Cincinnati, O.



NEW DESIGN OF MUELLER RADIAL DRILL

The column is of heavy construction to obtain rigidity and the elimination of vibration. It is ribbed internally and ground to size. The arm is of hollow rectangular section and has been increased considerably in weight. It can be securely locked to the column by the one tightener handle shown, which is conveniently located for the operator.

The head traverses the arm by rack and pinion and can be locked to it by two small tightener handles. The back gears are located on the head with the operating handle located to be in front of the operator, and can be thrown in and out without shock while the machine is in action. The tapping mechanism is equipped with a device to prevent breakage of taps.

The spindle is equipped with a depth gage and automatic stop and 24 changes of speed are available. A geared friction type of speed box allows 12 changes of speed.

A cone drive and universal box table can be furnished and any type of motor drive accommodated. The machine is built in 4-foot and 4½-foot sizes.

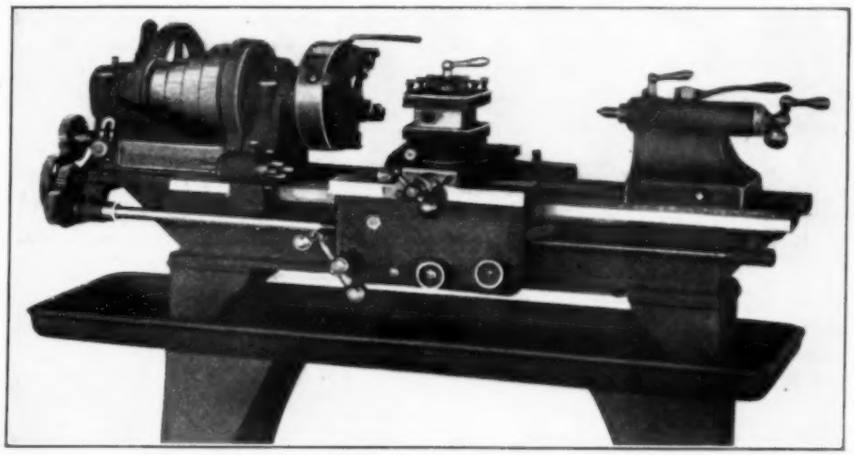
## Horizontal Boring, Drilling and Milling Machine

The accompanying halftone shows the latest type of horizontal boring, drilling and milling machine made by the Fosdick Machine Tool Company, Cincinnati, O., at work on the "Cino" motor. The casting is aluminum and all operations of boring and milling are done on the machine.

The machine has 23 inches spindle travel, 21 inches vertical head travel and 36 inches lateral table travel. All gearing and moving parts are incased. The table has a working surface of 50½ inches long by 23½ inches wide.

The drive is positive throughout; all spindle speeds, 8 in number, ranging from 12½ to 155 revolutions per minute, are reversible. The machine weighs net about 7700 pounds and occupies a floor space of 13 feet in line with spindle by 7 feet 8 inches wide.

Machining crank-case castings as illustrated is an interesting application of the machine showing its wide range in boring, milling and facing.



CARRIAGE TURRET AND TURRET TOOL POST COMBINED

## New Attachments for "Star" Lathes

The accompanying cut shows 2 new attachments for use on the 9-inch and 11-inch "Star" lathes manufactured by the Seneca Falls Manufacturing Company, Seneca Falls, N. Y.

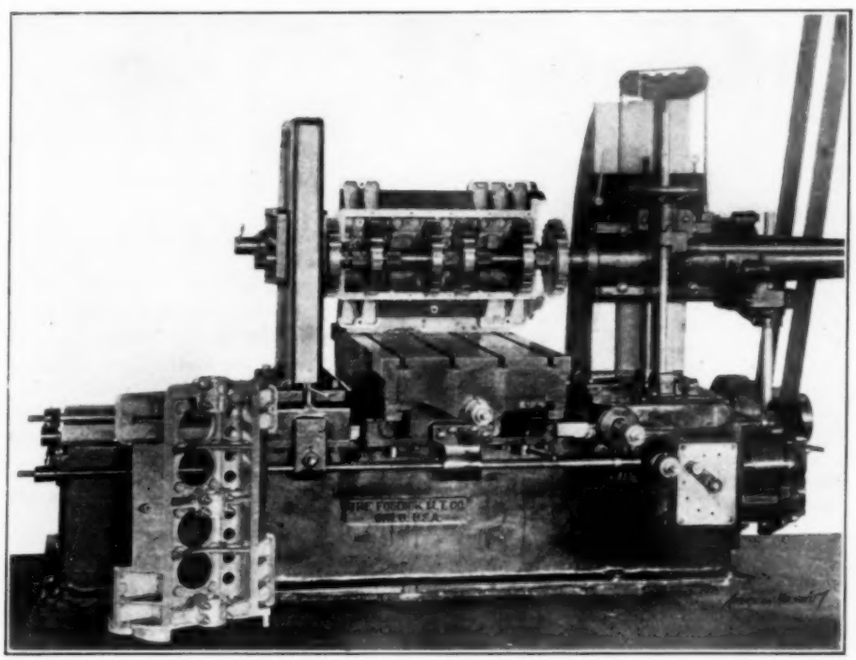
The combined carriage turret and turret tool post is mounted on the cross slide in place of compound rest. It has 4 holes for holding round-shank tools, also has binding screws for holding 4 flat tools. The tools may be fed to the work by the power cross and longitudinal feeds or the hand feeds may be used, as desired.

The carriage stop is clamped to bed in any desired position, and has a revolving cylinder with 4 adjustable stop rods. The cylinder is revolved by hand and held in position by detent spring and ball.

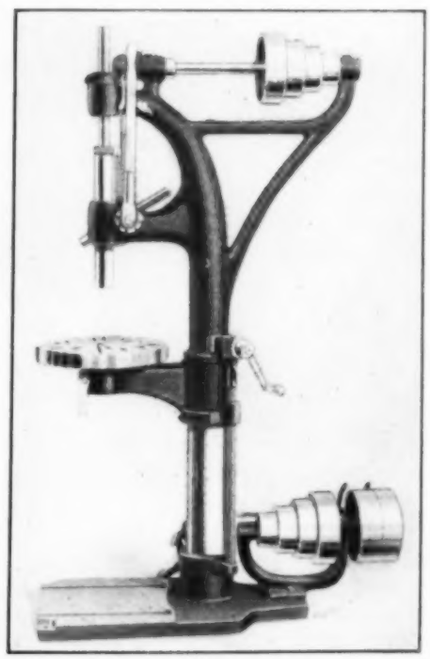
These two attachments may be used singly or together when facing and turning duplicate pieces, saving measuring each piece and each operation.

## A 20-inch Drill Press

The halftone shows a 20-inch drill press which is being put on the market



BORING, DRILLING AND MILLING MACHINE AT WORK



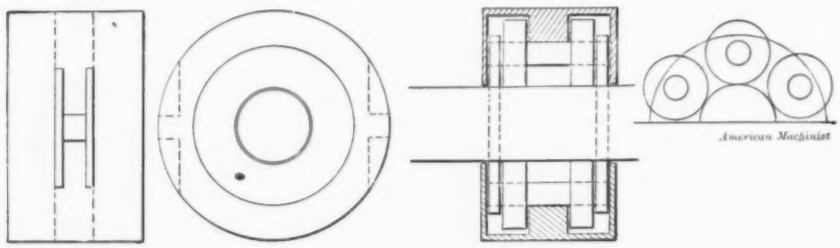
A 20-INCH DRILL PRESS

by the Frontier Iron Works, Letchworth and Grant streets, Buffalo, N. Y.

The machine occupies a space 42x15 inches and weighs 650 pounds. The machine can be had with lever feed or with both lever and wheel feed at extra cost. The spindle nose is Morse No. 3 taper.

## An Oilless Roller Bearing

The line cut shows a roller bearing which is being put on the market by the Troy Roller Bearing Company, Troy, N. Y. These bearings are run without oil,

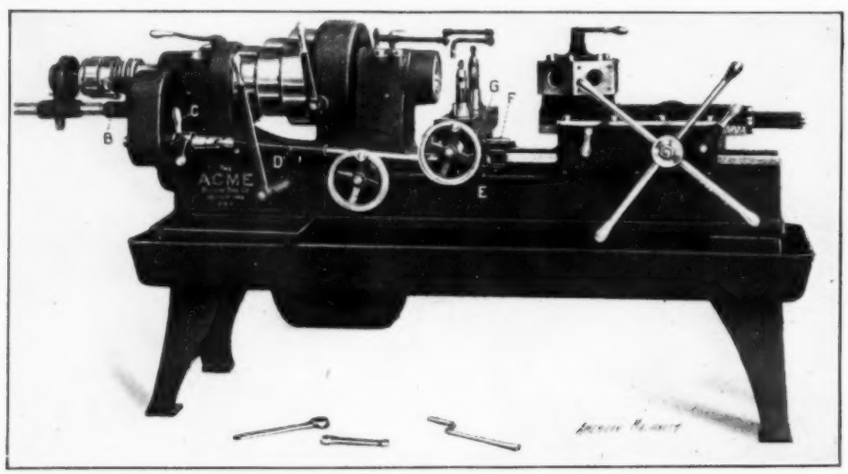



A Roller Bearing

a small amount of dry graphite only being required for lubrication. Bearings have been designed for practically all purposes, the one shown being used in the sewing-machine trade.

## A Screw Machine with Power Feed to the Cut-off Slide

The halftone shows a 2¼x11-inch screw machine, with power feed to the cutoff cross slide. It consists of a bracket *A*, which is bolted to the end of the head, holes being provided in all




2¼ by 11-inch Screw Machine with Power Feed to the Cut-off Slide

machines for attaching it. Three rates of feed may be obtained by a movement of the lever *C*, the rate of feed showing plainly on the index, which is attached to the lever. The direction of feed can be reversed by the handle *B*. The feed-changing mechanism is of the slip-key type. Power is transmitted through the shaft *D* to the worm in the worm box *E*, which engages with a worm gear on the cross-slide screw. The feed is thrown on or off by the lever *F*, when operated by hand, and is tripped automatically by the throw-off dogs *G*, when operated by power.

This power feed is found to be very useful in facing off large castings, forgings, etc., and work of a similar nature, and is also used in connection with the cutting-off tool. When so ordered, it can be made with a very fine feed which is suitable for forming and similar work. It is made and applied to machines of their manufacture by the Acme Machine Tool Company, Cincinnati, Ohio.

## Instruments for Alining and Leveling Shafting and Machinery

Figs. 1 and 2 show a special architect's level and a portable target with self-adjusting jaws for gripping shafts which are being put on the market by the Kinkead Manufacturing Company, 7 Water street, Boston, Mass. These instruments are used for leveling and alining shafting.

The level has an 11-inch telescope provided with cross hairs, magnifies to 20 diameters and is capable of handling a 600-foot line of shafting. Plumb bobs, keys, tripod and the adjustable base, shown in the halftone, are provided together with a mahogany case for the outfit. The target is provided with three

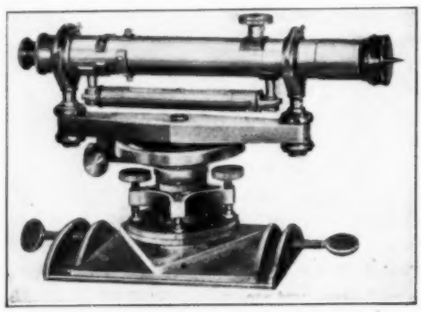


Fig. 1. Special Level

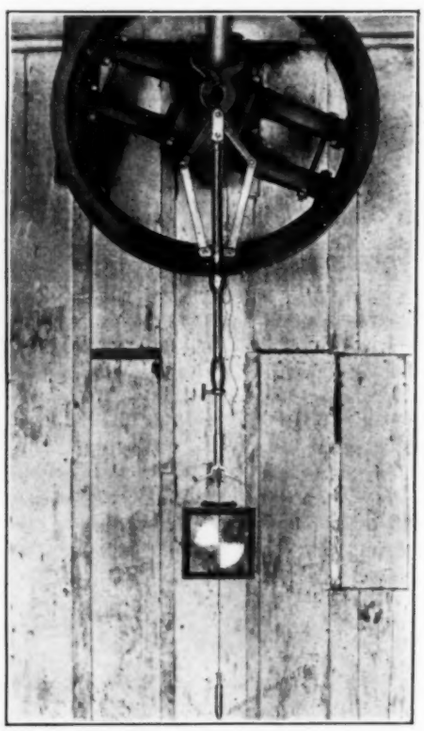


Fig. 2. The Target

sets of jaws to take shafting from 1 to 12 inches diameter, inclusive. The jaws are so constructed that the center of the target remains the same distance from the center of the shaft, irrespective of the diameter of the shaft from which it is hung. This feature is of considerable value where long shafts are to be alined, which are of various diameters coupled together.

## A Track Jack

The Duff Manufacturing Company, of Pittsburg, Penn., has recently brought out a new design of Barrett track jack which was designed especially for the New York Central Railroad.

The new jack is much shorter than other jacks, its hight when closed being 10 inches, with a 5½-inch raise. The weight is 55 pounds.

## Electric Hoist for Monorail System

The accompanying photograph illustrates an electric hoist with two hook blocks operating together and driven by

AN ELECTRIC HOIST FOR MONORAIL SYSTEM

the same motor, which is a design adapted for handling a great variety of work, on account of being able to pick up its load and carry it straight and level without the sway and unevenness that is apt to be present with the single hoist. This feature permits of making the supports for the runways narrow and does not require a wide operating space in the storage room or shop.

In handling heavy or bulky material, either one or both hooks can be used; either hook will hoist the full capacity of the hoist.

The hoist is furnished with a seat as shown, or with a cage when desired; when the seat is used, the operator makes the hitches and thereby saves the expense of a helper.

This hoist is built very rigid and solid; truck-wheel frames are made of steel castings and interlocked with the frame. They are made to swivel where curves are used.

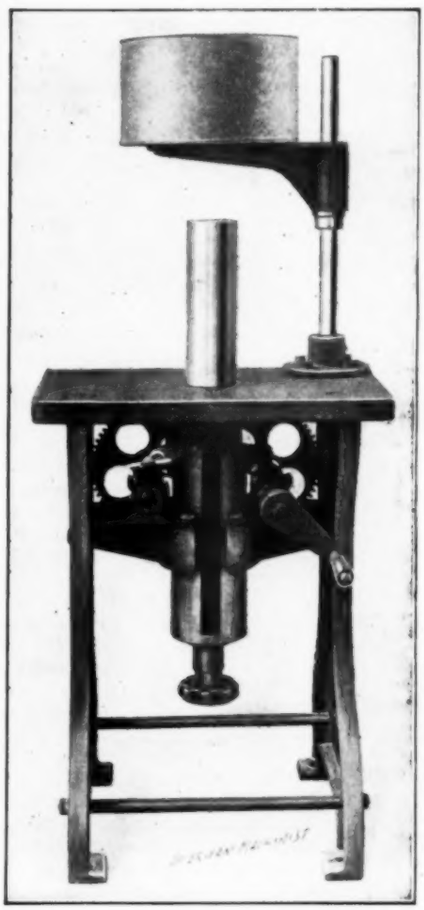
When desired, trolley will operate on a 3¼-per cent. grade, a foot or hand brake being used to control the speed on down grade.

The hoist is provided with an automatic load or mechanical brake for lowering, that is entirely inclosed, and operates in a bath of oil; it is also provided with an electric brake on the motor. Motors are of the inclosed type that is used for crane service. Gears are made of steel casting and have cut teeth.

These trolleys are made by the Johnston & Jennings Company, of Cleveland, Ohio, in two-, four- and six-ton capacities.

## A Core Machine

The halftone shows a core machine made by the Falls Rivet and Machine Company, Cuyahoga Falls, Ohio, and called the Wadsworth vertical jar ramming core-forming machine.



A CORE MACHINE

The core is formed in a vertical shell or core box, sand being supplied from the swinging hopper above the machine. As the sand is fed into the core box or shell the crank at the right is slowly rotated so that the ratchets upon the shafts at each side of the center of the machine alternately lift and drop the core box or core tube. The core tube works in a sleeve and is controlled by the adjusting screw shown. This screw is first adjusted as to the proper length of core to be made and then the tube is forced through the table of the machine by lifting the adjusting screw and turning it into the groove at one side of the vertical slot as shown.

For making an ordinary straight core the straight tube itself is all that is necessary. For irregular cores, special core boxes are introduced on the inside of the tube.

## A Substantial Screwdriver

This screwdriver is made in 5-, 6-, 8-, 10- and 12-inch blade lengths of 5/16-inch square stock. The handle has a large

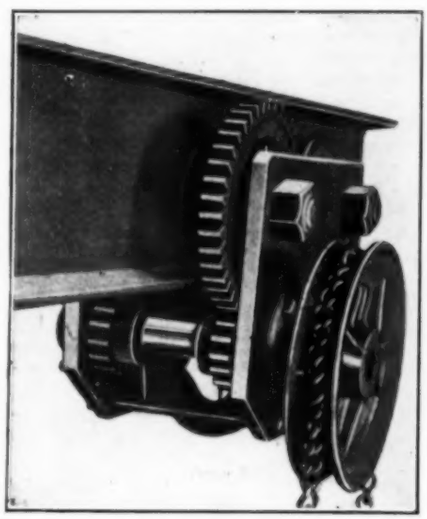
SOLID HANDLE SCREWDRIVER

steel ferrule which runs from the base of the shank to within a short distance of the head of the driver. This tool is made by the Ellis Company, 42 Church street, New Haven, Conn.

## An I-beam Trolley

The halftone shows an I-beam trolley built by the New Jersey Foundry and Machine Company, 90 West street, New York.

When handling heavy loads the pinions under the I-beam are in the position shown in the halftone. The trolley then can be racked along the beam by means of the hand chain. When handling light loads or with no load at all the pinions are thrown out of engage-



AN I-BEAM TROLLEY

ment with the gear and the trolley can be pulled along the I-beam by hand, the chain at the same time remaining stationary. The change from in to out of gear is accomplished by means of the hand chain.

# Increasing Shop Capacities

## Where More Tools Will be Needed

*Authentic news is solicited for this department. Real opportunities for the sale of machinery of any kind.*

The plant of the Eastern Grain Company, East Bridgewater, Mass., was burned. Loss, $25,000.

The plan of the Indiana (Penn.) Bent Rung Ladder Company was burned. Loss, about $50,000.

The Washburn Manufacturing Company, Westerly, R. I., a new concern, will erect a silk mill.

The Georgia Southern & Florida Railroad will soon start work on new shops at Valdosta, Ga.

The Vincennes (Ind.) Furniture Company has secured permit for the erection of an addition.

James H. Birch, carriage manufacturer, Burlington, N. J., is erecting a three-story addition.

The Davenport (Iowa) Ladder Company will erect a new factory in the West Park addition.

The J. S. Rowell Manufacturing Company, Beaver Dam, Wis., will erect a new blacksmith shop.

Fairbanks, Morse & Co., Beloit, Wis., is to erect a new building to be used as tool-making department.

The Southwestern Culvert Company, of Tulsa, Okla., is looking for suitable site for a new plant.

Plans are about completed for a two-story factory for the Jaeger Machine Company, Columbus, Ohio.

The Gimbal Bros. Company, Sacramento, Cal., contemplate the establishment of a large candy factory.

The plant of the Poland Laundry Machinery Company, Roxbury, Mass., was burned. Loss, $10,000.

C. W. Cheney Company will erect a 125-barrel flour mill at Eau Claire, Wis., to cost about $25,000.

The Springfield (Mass.) Foundry Company, it is reported, will build a large plant in Indian Orchard.

The Atlas Foundry Company Company, Detroit, Mich., has leased buildings for operation of foundry.

The plant of the M. L. Davis Lumber Company, Oak Grove, Ala., was destroyed by fire. Loss, $300,000.

The Veerac Motor Company, of Minneapolis, Minn., may erect an automobile factory at Anoka, Minn.

The plant of the McKain Manufacturing Company, Los Angeles, Cal., millwrights, was destroyed by fire.

The Faukes Auto Company, Minneapolis, Minn., will erect a new factory at Hennepen and Erie avenues.

The Hanna Frederich Company, of Houston and San Antonio, will build a cotton compress at Victoria, Texas.

C. M. Lawrence, Griswold, Iowa, is considering the erection of a brick building for a blacksmith shop.

The General Electric Company has placed contract for the construction of a new building at Lynn, Mass.

George White & Sons, London, Ont., manufacturing threshing engines, are erecting a new $100,000 plant.

Contract has been awarded for the erection of a factory for the Warren cotton mills at West Warren, Mass.

The plant of the Rapid City (S. D.) Dry Cleaning and Dye Works was destroyed by fire. Will be rebuilt.

F. D. O'Keefe is at the head of a company to build a furniture factory at Carthage, N. Y., to cost $60,000.

The Zenith Fuel Saver and Smoke Abater Company is planning the erection of a factory at Willmar, Minn.

The Quad Stove Company, Columbus, Ohio, will build an addition to its plant for the manufacture of tinware.

The Dunbar Stove Company, Delray, Mich., is erecting another building which will double the capacity of its plant.

The mill of the American Sheet and Tin Plate Company, at Canton, Ohio, was wrecked by an explosion.

The Curtis & Yale Company, Wausau, Wis., manufacturing sash, doors, blinds, etc., is building a large addition.

The Hills Company, Amherst, Mass., manufacturing straw hats, will enlarge its factory and improve engine room.

The S. Morgan Smith Company, York, Penn., building water turbines, etc., is erecting a four-story addition.

The Builders' Sideboard Company is having a new plant erected at 209 Fifth street, N. E., Minneapolis, Minn.

The Hobbs Plate Glass Works, London, Ont., recently destroyed by fire, is being rebuilt and greatly enlarged.

The plant of the South Norfolk (Va.) Box and Foundry Company was destroyed by fire, causing a loss of $25,000.

The S. W. Card Manufacturing Company, Mansfield, Mass., manufacturing taps, is building a four-story addition.

The American Art Leather Company, Los Angeles, Cal., is to erect a new factory, having outgrown its present one.

The Inlaid Company, manufacturing celluloid novelties is erecting a new factory on Broad street, Providence, R. I.

The plant of the General Explosive Company, at Hull, Quebec, Canada, was destroyed by fire, causing great damage.

The Watt Machinery Company, of Ridgetown, Ont., will move to London, Ont., where a new factory is being erected.

The E. A. Russ Company, Cleveland, Ohio, manufacturing beer pumps, will be in the market for a molding machine.

The tannery of Arthur & Pierre Pouliot, on Arago street, Quebec, Canada, was destroyed by fire. Loss, $25,000.

The New Crown Electric Company has let contract for the construction of a plant on Lydenham street, Brantford, Ont.

The Illinois Watch Company, Springfield, Ill., will erect a two-story addition and add an extra story to another building.

The Fort Schuyler Knitting Company, Utica, N. Y., is completing plans for the erection of an addition to its plant.

The plant of the Manitowoc (Wis.) Glue Company was taken over by Armour & Co., and new machinery will be installed.

The Moline (Ill.) Pump Company has to vacate its present plant and will probably locate in East Moline, or Rock Island.

Plans are being prepared for a six-story mill for the A. J. Cameron Company, Philadelphia, Penn., manufacturer of yarns.

Catalogs and quotations on paper-cutting machines are desired by Ph. Lambadorios & Co., Rue Athinaidos 12, Athens, Greece.

Uwanta Wrench Company, Meadville, Penn., is in the market for tools for a new forge shop, hammers, furnaces, trimmers, etc.

The plant of the Pittsburg (Penn.) Cap Pistol Company, at Homestead Park, was damaged by fire to the extent of $7000.

The Portage (Wis.) Hosiery Company is said to be considering the establishment of a branch factory in the Central West.

The Pullman Company has under consideration the question of establishing a car building and repair plant in Denver, Colo.

The Big Four Railroad Company contemplates the erection of a shop in Springfield, Ohio, to employ from 300 to 500 men.

The Fischer Machine Company, 1217 Race street, Philadelphia, Penn., has taken larger quarters and will install new machinery.

The National Chemical Company, Syracuse, N. Y., has purchased the Old Farmers Fertilizer plant and will refit it at once.

The Jamestown (N. Y.) Wheel and Manufacturing Company is said to be looking for suitable site for a large and modern plant.

Contract has been awarded for the erection of an addition to the machine shop of the A. O. Lombard Company, in Waterville, Me.

John A. Sandholm, of Des Moines, Iowa, will commence the erection of a $200,000 mill at the Alder Creek mine, Deadwood, S. D.

The Union Cooperage Company, Aberdeen, Wash., will enlarge its plant and install about $10,000 worth of additional machinery.

The Capital Traction Company, Washington, D. C., has purchased site in Georgetown on which a new power house will be erected.

The Isthmian Canal Commission, Washington, D. C., will call for bids on five 1-ton hoists, three 2-ton hoists, two 5-ton hoists.

The International Harvester Company will start additions to shops at Springfield, Ohio, which will necessitate employing 800 more men.

The Keystone Enameling Company, Pittsburg, Penn., manufacturing enameled cooking ware, etc., is looking for site for a new plant.

The Fall River (Mass.) Iron Works Company contemplates the erection of another cotton cloth mill to employ about 1000 more hands.

The Union Fork and Hoe Company, Columbus, Ohio will soon have plans completed for a large addition to its plant on Dublin avenue.

The Reliance Electric and Engineering Company, with headquarters in the Caxton building, Cleveland, Ohio, will erect a new factory.

The International Harvester Company, Hamilton, Ont., is building an addition to its molding shop; is also planning other extensions.

The Wichita Falls & Northwestern Railroad has let contract for the construction of roundhouse and machine shops at Wichita Falls, Tex.

J. L. D'Almeida & Filhos, Mortagua, Portugal, desire catalogs of typewriters and sewing machines. Correspondence in Portuguese or French.

The Johnson Service Company, Milwaukee, Wis., is to build a new factory to be devoted to the manufacture of commercial automobiles and trucks.

The Kaiserman Roller Shade Company, Kankakee, Ill., is to erect a temporary frame factory and expect later on to put up a modern brick plant.

Ground has been broken for the first of four buildings to constitute the plant of the National Steel Foundry Company, at Sandusky, Ohio.

The Franklin Foundry, Franklin Falls, N. H., will erect a new foundry and has secured a building which it will equip as a machine shop.

The Kaestner Company, Chicago, Ill., machinery manufacturers, have bought site on which a new plant, to cost about $250,000, will be erected.

The O. M. Edwards Company, Syracuse, N. Y., manufacturing window fixtures, etc., is to build several additions, doubling the capacity of plant.

The Hydraulic Press Steel Company, Cleveland, Ohio, is erecting several additions, including garage, pickling room and extension to machine shop.

The Stuyvesant Motor Car Company, of Cleveland, Ohio, is investigating throughout the Central West preparatory to securing site for a new plant.

Bellamy & Lambie, P. O. Box 453, Johannesburg, South Africa, importers of mining machinery, would like catalogs, quotations, etc., of machine tools.

The A. L. Blackner Company, New Bedford, Mass., manufacturing cut glass, has purchased site for a new factory for which plans have been drawn.

The William Rahr Sons Company, of Manitowoc, Wis., is having plans prepared for the erection of a new brewery to cost several hundred thousand dollars.

Gaar, Scott & Co., Richmond, Ind., is planning the erection of an addition for the manufacture of its boilers and gas engines, which are now being made elsewhere.

The New Way Motor Company, of Lansing, Mich., has secured site at Welland, Ont., and will erect a plant for the manufacture of air-cooled gas and gasolene engines.

The W. S. Tyler Company, Cleveland, Ohio, manufacturing wire and ornamental iron goods, has purchased more land on which a large addition will be erected.

The W. S. Nott Company, Minneapolis, Minn., manufacturing rubber goods, leather belting, fire extinguishers, will erect a new six-story factory to cost $150,000.

The Breeze Lumber and Manufacturing Company, of Portsmouth, Ohio, will establish a plant at Selma, Ala., for the manufacture of hardwood parts for automobiles.

The New Jersey Rubber Company, Lambertville, N. J., is to build an addition to its factory, also new power house in which new engines and boilers will be installed.

The American Steel and Wire Company will expend more than $2,000,000 in the Cleveland district within the next two years in enlarging the capacity of its plants.

The Peerless Manufacturing Company, Louisville, Ky., manufacturing grates, is erecting an addition to be used as foundry, present foundry to be used as warehouse.

The F. W. Spacke Machine Company, Indianapolis, Ind., manufacturer of air compressors, automobile parts, etc., has completed plans for a four-story addition.

It is stated the Seamless Pressed Steel Company, of Red Key, Ind., is planning the establishment of a branch plant in the Central West for which it is seeking site.

The Peet Brothers Manufacturing Company, Kansas City, Mo., whose soap factory recently burned, is planning the erection of a new and larger plant to cost $350,000.

The Thomas Motor Cab Company, Buffalo, N. Y., has leased a portion of the building occupied by the Century Tel. Construction Company, and will manufacture taxicabs.

It is announced the National Tube Company will soon start the erection of a plant at Gary, Ind. This will include 18 blast furnaces and will employ from 15,000 to 18,000 men.

Plans are being drawn for the erection of a series of factory buildings at Milwaukee, Wis., for the Globe Seamless Steel Tube Company, of Chicago. Plant will employ 1000 men.

E. Greenfield's Son & Co., 107 Lorimer street, Brooklyn, N. Y., confectionery manufacturers, have awarded contract for the construction of a six-story factory and two-story garage.

Fire destroyed the condensing building and badly damaged the engine house at the plant of the Lake Superior Iron and Chemical Company, Elk Rapids, Mich. Loss, about $10,000.

The West Steel Casting Company, Cleveland, Ohio, is making further additions to its plant and will install new machinery to increase output of crucible- and converter-steel castings.

The Bayonne (N. J.) Steel Casting Company has purchased property of the Goubert Manufacturing Company and will erect addition building. Between 200 and 300 men will be employed.

The Pressed Steel Car Company, South Bethlehem, Penn., has purchased 100 acres of ground at Schenectady, N. Y., and is having plans drawn for the erection of a plant, which is to employ 5000 men.

The Rector Gas Lamp Company, 131 West Thirty-first street, New York, is said to be interested in the establishment of a large and modern factory to be located in the Middle Atlantic section.

The Helming McKenzie Shoe Company, North Cincinnati, Ohio, is receiving estimates for a new power plant to contain two engines and three boilers. Will also build an addition to its main plant.

The Landis Machine Company, Waynesboro, Penn., has nearly completed the large new addition to its plant, which will enable the company to increase its output of bolt cutters and pipe-threading machines.

The Peterson-Brown Manufacturing Company is being formed at Canton, Ohio, to manufacture a new kind of window device. J. M. Bostick, secretary. The company is looking for suitable site for a plant.

The American Sanitary Works, Washington, N. J., with offices at 320 Broadway, New York, which manufactures plumbers' materials and supplies, is considering the establishment of a branch plant in Canada.

A new 6,000,000-gallon turbine pump, costing $30,000, will be among the items in the $375,000 bill for water extension in the city of Montreal, Canada. A good portion of the sum will be spent on piping and mains.

Akron Inner Tube Company is being formed at Akron, Ohio, with $10,000 capital, and will erect a plant for the manufacture of inner tubes. Jesse E. Dice, Thos. E. Erally, Frank J. Mishler and others are incorporators.

Plant formerly occupied by New York Car and Truck Company, Kingston, N. Y., has been bought by the W. A. Wood Auto Manufacturing Company, who will do a large auto and bicycle business, employing several hundred hands.

The Latta Tack Manufacturing Company, Buffalo, N. Y., recently incorporated, has secured site at Ellicottville, and is having plans drawn for the erection of a plant. Frank Latta, 180 Forest avenue, Buffalo, is president and manager.

Work has been started on a new plant for the Sommer Motor Company, at Bucyrus, Ohio. Besides the main building there will be a separate power plant. This plant was secured through the efforts of the Bucyrus Industrial Association.

The Ferrocarril Central del Peru, Casilla No. 492, Lima, Peru, would like catalogs and quotations on railway supplies of every description, including machinery, materials and equipment, also machines and equipment for railway-repair shops. Correspondence in Spanish.

The Hastings (Mich.) Motor Shaft Company, a new concern, is erecting a plant in which will be manufactured solid cam shafts, crank shafts and motor specialties. Company is capitalized at $50,000 and composed of local men, Arthur E. Mulholland, being president.

The Atlas Car and Manufacturing Company, at present on Marquette avenue, near St. Claire avenue, Cleveland, Ohio, will have a plant erected in the new district, and the Atlas Bolt and Screw Company, an associated concern, is preparing to build a large factory also.

The Kinsey Manufacturing Company, Toledo, Ohio, has let contract for the erection of a new three-story plant to have double the floor space of present one. A large amount of new machinery will be installed. The company manufactures frames, oilers, hoods and other automobile accessories.

The Moore Heating and Manufacturing Company, Akron, Ohio, has acquired the Barberton steel foundry plant at Barberton, Ohio, and is negotiating for another factory for the manufacture of its stoves and heating furnaces. Machine tools, including lathes, grinders, presses, etc., will be needed.

The Isthmian Canal Commission, Washington, D. C., is to call for bids on the following material: 16 steel hopper frame castings, 16 steel hopper gate castings for Dredge Caribbean, patterns to be furnished by the commission; also 25 best quality rubber dredge sleeves, 12½x30 inches. 10,000 feet flexible cast-steel cable 9/16 inch in diameter.

The Parker Transmission and Appliance Company, Springfield, Mass., is planning to erect a large plant in Springfield within a year or so. Present quarters are in the building with the Waltham Watch Tool Company, where over $30,000 worth of machine tools are now being installed. It is said that later purchases will be on a large scale. The company manufactures transmission device for motors, machine tools, etc.

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: May 31—Hoisting engine and boiler complete (schedule 2495); June

7—Rotating pillar crane, electric drive (schedule 2491), universal turret lathe, geared friction head screw machine (schedule 2519), sand belt machine (schedule 2518), two 2- and 3-h.p. motors (schedule 2518); June 14—Lead pipe, 27,700 pounds (schedule 2516), 103 brass gate valves, 501 brass globe and angle valves (schedule 2517), pipe-cutting and threading machine (schedule 2490).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open the following bids: May 31—2300 water-gage glasses (schedule 2510), blueprint paper (schedule 2496), 12,700 pounds lead pipe, 17,500 feet iron or steel steam pipe, 13,000 pounds brass tubing (schedule 2507), 2100 feet steel or wrought-iron pipe (schedule 2509), bolts and nuts (schedule 2510), brass bilge ejectors, roller type tube expanders (schedule 2510), twist drills (schedule 2500), drills and sockets, files and rasps, 25 portable rivet forges, 245 hammers and hatchets, hardware and tools (schedule 2502).

The Navy Department, Bureau of Supplies and Accounts, Washington, D. C., will open bids May 31 for the following: 700 pounds hoop brass, 5100 pounds braziers' soft brass (schedule 2504), 2600 pounds round drawn brass, 2850 pounds naval bronze, 25,500 pounds forged steel, 2510 pounds sheet and pipe lead (schedule 2499), 15,620 pounds steel forging, 10,000 pounds rolled-zinc boiler plates, 20,000 pounds rolled-sheet zinc boiler plates (schedule 2509), 2600 pounds flat bar iron, 1805 pounds sheet lead in rolls, 26,000 pounds medium steel plates, 8000 pounds rivet steel, 15,000 pounds galvanized sheet steel (schedule 2505).

## BUSINESS ITEMS

Garwood Electric Company has appointed George F. Herrig Company, of Saginaw, Mich., as its agent, its territory being Saginaw, Mich., and all territory within a radius of 50 miles of Saginaw.

The Western Tool and Manufacturing Company, of Springfield, Ohio, has purchased the power hack-saw business of the C. J. Weinman Company, of Dayton, Ohio, and as it has added to that purchase another power hack-saw of worth, it will in the near future put on the market a full line of power hack saws.

The Espen-Lucas Machine Company, manufacturers of cold-sawing machines, floor-boring tools, etc., has moved into its new shop at Front and Girard streets, Philadelphia, Penn., quadrupling its former floor space, increasing its equipment and extending its facilities generally to take care of its greatly increased business.

## NEW INCORPORATIONS

New England Motor Truck Company, Hyde Park, Mass. Automobiles. Capital, $50,000. B. W. Piper, Hyde Park, president.

The Fostoria Iron and Pipe Company, Fostoria, Ohio. Capital, $10,000. Incorporators, Mark Levy, J. Stephens, Joseph Poley, etc.

Bloomfield Garage, Bloomfield, N. J. Operate garage. Capital, $10,000. Incorporators, Herbert J. Ashley, W. H. Samuel, Nelson B. Marr.

United States Wheel Company, New York. Manufacture wheels. Capital, $1,000,000. Incorporators, J. Tooker, S. P. McConnell, B. M. Fellows.

Wisconsin Automobile Radiator Company, Milwaukee, Wis. Capital, $50,000. Incorporators, Gerhard Aussem, S. S. Landt, Arthur Zancing.

Louisburg Company, Boston, Mass. Manufacture pins, hooks, etc. Capital, $25,000. E. Heard, president; J. H. Sherburne, Jr., treasurer.

Vulcan Machine Company, Cleveland, Ohio. Manufacture and sell machinery of all kinds. Incorporators, H. Pfarr, W. H. Bosworth, H. W. Sanders.

Bronze Metal Company, Augusta, Me. Metal castings and foundry work. Capital, $1,000,000. E. M. Leavitt, Winthrop, Me., president and treasurer.

Automatic Lock Nut and Bolt Company, Portland, Me. Locks, nuts, bolts, etc. Capital, $1,000,000. A. G. McPherson, president; B. Smith, treasurer.

Chicago Auto Clock Company, Chicago, Ill. Manufacture automobile clocks. Capital, $50,000. Incorporators, A. L. Benner, W. M. Lawton, O. G. Knecht.

United Auto Company, Newark, N. J. Manufacture automobiles, etc. Capital, $100,000. Incorporators, S. H. Levy, Joseph Sonnabend, P. J. Schotland.

Bridgeton Paper Box Company, Bridgeton, N. J. Manufacture paper boxes, bags, etc. Capital, $25,000. Incorporators, A. B. Ralph, L. Sagel, C. F. Cox, etc.

The C. R. Talbot Company, Cincinnati, Ohio. Iron and steel products. Capital, $50,000. Incorporators, C. R. Talbot, L. E. Denman, M. Duffessy, etc.

Knickerbocker Brass Goods Company, New York. Manufacture and deal in brass goods. Capital, $50,000. Incorporators, E. J. Forhan, J. J. Harper, G. T. Martin.

United Manufacturing Company, Leipsic, Ohio. Manufacture fire extinguishers. Capital, $10,000. Incorporators, H. A. Huttinger, M. I. Huttinger, H. F. Wendell, etc.

Chicago Nipple Manufacturing Company, Chicago, Ill. Manufacture metal nipples. Capital, $10,000. Incorporators, Wm. E. Freer, Roy F. France, D. G. Einstein.

Kewanee Foundry and Manufacturing Company, Kewanee, Ill. Manufacture tools and machinery. Capital, $40,000. Incorporators, L. Brutus, E. W. Smith, T. H. Johnston.

Flanders Tile Company, Bettsville, Ohio. Manufacture tile, brick, cement, etc. Capital, $20,000. Incorporators, Geo. S. Flanders, H. W. Auld, Chas. E. Andrews, etc.

Edgar Allen Manganese Steel Company, Chicago, Ill. Manufacture steel and its products. Capital, $300,000. Incorporators, John C. Ward, Herbert Ward, S. R. Skelton.

American Acetylene Company, Cleveland, Ohio. Manufacture acetylene generator and equipment. Capital, $25,000. Incorporators, Jos. J. Klein, Jos. Hidy, I. M. Farschuter, etc.

Belvidere Screw and Machine Company, Belvidere, Ill. Manufacture machine products. Capital, $100,000. Incorporators, W. S. Brown, T. B. Whitman, G. M. Marshall.

Universal Comfort Chair Company, Akron, Ohio. Manufacture chairs and all kinds of furniture. Capital, $10,000. Incorporators, Chas. Pfeiffer, Henry A. Mueller, Adolph J. Halter.

Talbert Auto Specialty Company, Cleveland, Ohio. Manufacture automobile parts, specialties, etc. Capital, $25,000. Incorporators, Samuel P. Dunn, D. E. Beveridge, J. A. Burke, etc.

Bauvoth Machine Company, Toledo, Ohio. Manufacture presses, dies, tools, special machines, stampings. Capital, $20,000. Incorporators, L. Bauvoth, E. F. Bauvoth, Hugo Bickel, etc.

Findlay Automobile Company, Findlay, Ohio. Manufacture and deal in automobiles, motor trucks and accessories. Capital, $10,000. Incorporators, L. D. Firman, F. E. Hurley, M. N. Poe.

Simplex Interlocking Steel Stair Company, New York. Manufacture metal stairs and construction of all kinds. Capital, $250,000. Incorporators, H. L. Johnston, C. H. Teller, A. H. Bissell.

New England Time Test Company, Gloversville, N. Y. Manufacture and deal in automobile tires and appliances. Capital, $300,000. Incorporators, J. Moses, T. B. Robinson, R. A. Moses.

Newark Wagon Company, Newark, N. Y. Manufacture and deal in wagons, automobiles, etc. Capital, $100,000. Incorporators, S. F. Sherman, Newark; T. E. Wright, W. H. Osborn, Mexico.

Multipost Company, Rochester, N. Y. Manufacture and deal in stamp-vending machines, adding machines, etc. Capital, $200,000. Incorporators, W. H. Shaffer, W. F. Strang, W. F. Schweiger.

Fayette Anti-Freezing Tank Company, Fayette, Ohio. Manufacture tanks, water heaters, engines, furnaces, etc. Capital, $25,000. Incorporators, Jas. M. Morgan, Wm. C. Leist, C. G. Calkins, etc.

Ashworth Brothers, Inc., Fall River, Mass. Manufacture machinery, tools, apparatus and textile goods. Capital, $400,000. Incorporators, Henry Ashworth, Robert C. Ashworth, Charles M. Clark.

Progressive Electrical Company, Van Wert, Ohio. Generate and distribute electricity for power, light, etc. Capital, $10,000. Incorporators, F. S. Atkinson, George W. Kohn, Hiram C. Glenn, etc.

Crescent Brass Manufacturing Company, Cleveland, Ohio. Manufacture brass and other metal articles. Capital, $10,000. Incorporators Chas. H. Hofricher, Wm. J. Luck, E. G. Steeb, etc.

Graham Differential Gear Company, Chicago, Ill. Manufacture and deal in automobiles, accessories and machinery. Capital, $150,000. Incorporators, Percival Steele, J. T. Tyrrell, G. J. Jeffries.

Gas Engine andAppurtenance Company, Cleveland, Ohio. Manufacture and sell gas engines, motor vehicles, motorboats, etc. Capital, $10,000. Incorporators, Andrew B. Nichols, Edward H. Sherbourne, etc.

American Range and Foundry Company, Cleveland, Ohio. Manufacture steel castings, stoves, ranges, heaters, etc. Capital, $150,000. Incorporators, Norman R. Widlar, Harry H. Penty, Oscar F. Alexander, etc.

Sickels-Loder Company, New York. Manufacture and deal in agricultural tools and implements. Capital, $50,000. Incorporators, Jas. R. Loder, 77 Gifford avenue, Jersey City, N. J.; Otto Dederer, 4180 Broadway, New York, etc.

Premier Automatic Cashier Company, Syracuse, N. Y. Manufacture and deal in cash registers, check-printing machines, adding and calculating machines. Capital, $150,000. Incorporators, C. B. Cory, B. T. Burdick, E. J. Richardson.

New Process Machinery Manufacturing Company, Newark, N. J. Manufacture machinery, etc. Capital, $100,000. Incorporators, Edward O. Stanley, Jr., 40 Hawthorn avenue, East Orange, N. J.; Geo. W. Perry, 24 Mechanic street, Orange, N. J.

Hartford Rubber Works Company, New York. Manufacture and deal in all kinds of articles composed of rubber, gutta-percha, etc. Capital, $10,000. Incorporators, Herman Goldman, 50 East Eighty-ninth street, Russell Goldman, 124 East Ninety-first street, etc.

Russell Generator Company, Jersey City, N. J. Manufacture gas generators for internal combustion engines, and for light, heat and power purposes, such as automobiles, motorboats, etc. Capital, $100,000. Incorporators, E. J. Reilly, Patrick McGann, Weehawken; Wm. H. Russell, 257 Webster avenue, Jersey City, etc.

## TRADE CATALOGS

F. E. Reed Company, Worcester, Mass. Catalog of lathes. Illustrated, 108 pages, 8½x11 inches, paper.

Northern Engineering Works, Detroit, Mich. Catalog No. 51, describing Newten cupola. Illustrated, 12 pages, 6x9 inches, paper.

Bickford & Washburn, Inc., Greenfield, Mass. Catalog of thread-milling machines. Illustrated, 24 pages, 4½x7 inches, paper.

S. K. F. Ball Bearing Company, 50 Church street, New York. Catalog of S. K. F. ball bearings. Illustrated, 62 pages, 4½x7 inches, paper.

The Washburn Shops, Worcester Polytechnic Institute, Worcester, Mass. Catalog describing Worcester drill grinders. Illustrated, 20 pages, 6x9 inches.

Davenport Machine Tool Company, New Bedford, Mass. Catalog describing multiple spindle automatic screw machine. Illustrated, 16 pages, 6x9 inches, paper.

Lucas Machine Tool Company, Cleveland, Ohio. Circular C-7, illustrating and describing power-forcing press. Circular E-2, illustrating and describing No. 21 "Precision" boring, drilling and milling machine.

A. J. Smart Manufacturing Company, Greenfield, Mass. Catalog No. 1, describing taps. Illustrated, 46 pages, 4½x7 inches, paper. Catalog No. 2 and supplement, screw plates, die stocks, wrenches. Illustrated.

## FORTHCOMING MEETINGS

American Society of Mechanical Engineers, spring meetings, Atlantic City, N. J., May 31-June 3. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Engineers' Society of Pennsylvania will hold their second annual State convention at Harrisburg, Penn., June 1-4, 1910.

American Foundrymen's Association and American Brass Founders Association; joint convention, June 7-8-9, Detroit, Mich.; headquarters, Hotel Pontchartrain. Richard Moldenke, secretary, Watchung, N. J.

National Gas and Gasolene Engine Trades Association. Semi-annual convention, Cincinnati, Ohio, June 13-16, 1910; headquarters, Hotel Sinton. Albert Stritmatter, secretary, Cincinnati, Ohio.

Master Car Builders Association; annual meeting June 15-17, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

American Railway Master Mechanics Association, June 20-22, Atlantic City, N. J. J. W. Taylor, secretary, Old Colony building, Chicago, Ill.

Society for the Promotion of Engineering Education; tenth annual convention, June 23-25, Madison, Wis. H. H. Norris, secretary, Cornell University, Ithaca, N. Y.

American Society for Testing Materials; thirteenth annual meeting, June 28-July 2, Hotel Traymore, Atlantic City, N. J. Edgar Marburg, secretary, University of Pennsylvania, Philadelphia, Penn.

Joint meeting of American Society of Mechanical Engineers and Institution of Mechanical Engineers, Birmingham, England, July 26-29, 1910.

American Society of Mechanical Engineers; monthly meeting second Tuesday. Calvin W. Rice, secretary, 29 West Thirty-ninth street, New York City.

Boston Branch National Metal Trades Association. Monthly meeting on first Wednesday of each month, Young's hotel. D. F. P. Clark, secretary, 309 Milk street, Boston, Mass.

Providence Association of Mechanical Engineers. Monthly meeting fourth Tuesday each month. E. C. Bliss, president, 91 Sabine street, Providence, R. I.

New England Foundrymen's Association; regular meeting second Wednesday of each month, Exchange Club, Boston, Mass. Fred F. Stockwell, 205 Broadway, Cambridgeport, Mass.

Engineers' Society of Western Pennsylvania; monthly meeting third Tuesday. Elmer K. Hiles, secretary, Fulton building, Pittsburg, Penn.

Superintendents' and Foremen's Club of Cleveland; monthly meeting third Saturday. Phil. Frankel, secretary, 310 New England building, Cleveland, O.

Western Society of Engineers, Chicago, Ill. Regular meeting first Wednesday evening of each month, excepting July and August. Secretary, J. H. Warder, 1735 Monadnock block, Chicago, Ill.

## WANT ADVERTISEMENTS

*Rate 25 cents per line for each insertion. About six words make a line. No advertisements abbreviated. Copy should be sent to reach us not later than Friday for ensuing week's issue. Answers addressed to our care will be forwarded. Applicants may specify names to which their replies are not to be forwarded, but replies will not be returned. If not forwarded, they will be destroyed without notice. No information given by us regarding any advertiser using box number. Original letters of recommendations or other papers of value should not be inclosed to unknown correspondents. Only bona-fide advertisements inserted under this heading. No advertising accepted from any agency, association or individual charging a fee for "registration," or a commission on wages of successful applicants for situations.*

## Miscellaneous Wants

Caliper catalog free. E.G. Smith, Columbia, Pa.

Oilstone holder mailed for 25c. F. J. Badge, 286 Taaffe Place, Brooklyn, N. Y.

We buy or pay royalty for good patented machine or tool. Box 282, AMER. MACHINIST.

Light, fine machinery to order; models and electrical work specialty. E. O. Chase, Newark, N. J.

Special machinery accurately built. Screw machine or turret lathe work solicited. Robert J. Emory & Co., Newark, N. J.

Light and medium weight machinery and duplicate parts built to order; tools, jigs, etc. MacCordy Mfg. Co., Amsterdam, N. Y.

Patents. C. L. Parker, Patent Attorney, ex-examiner Patent Office, 990 G St., Washington, D. C. Write for Inventor's Handbook.

Mr. Algernon Curtis, engineer and publisher, Chatteris, England, solicits correspondence from manufacturing concerns with a view of representing their interests in Europe on commission.

Experienced firm in Vienna, Austria, is open to take charge of very high-class machinery, machine tools, apparatus, etc., for Austria-Hungary. Write to "H. 2373" a Haasenstein & Vogler A. G., Vienna, I.

A large English firm of machine-tool importers having showrooms and offices in Great Britain, France, Italy and Japan, is wanting good agencies for machine tools of all kinds. Apply Box 189, AMERICAN MACHINIST.

We are about to complete a large contract and are, therefore, in a position to take up the manufacture of fine instruments, parts for the same, dies and jigs, etc. Precision Tool & Instrument Co., 9-15 Canal Place, New York City.

A German mechanical engineer, with five years' American experience, wants to represent a few good lines of American machinery in Great Britain, France and Germany; proposes to personally visit all leading shops and solicit orders on commission basis; have arranged to sell for the Sloan & Chace Mfg. Co., Ltd., Newark, N. J., but want other lines. Box 538, AMERICAN MACHINIST.

Wanted—Some light work in metal manufacturing by a progressive Massachusetts company who are at present turning out a high-grade mechanical product and have been doing so for over forty years; we employ one thousand hands and have a thoroughly modern plant with uptodate machinery and facilities; we would not consider anything but a large and steady contract from thoroughly reliable parties; correspondence solicited. Address "Facilities," Box 535, AMER. MACH.

## Help Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Wanted — First-class toolmakers, particularly on punches and dies, steady work; wages from 35c. to 45c. an hour. Apply Canadian General Electric Co., Ltd., Petersboro, Ont.

COLORADO

Due to the steady increase of our business, we are constantly in need of drill press, lathe, planer, grinder, Jones & Lamson and bench men; also toolmakers and tool smiths; good climate and location; steady work, good pay to first-class men; shop clean, light and well ventilated; 9 hours' work. Address, stating experience, J. Geo. Leyner Engineering Works Co., Littleton, Colo.

CONNECTICUT

Wanted—First-class patternmakers on automobile work; highest wages paid. Apply Factory Office: The Pope Manufacturing Co., Hartford, Conn.

DELAWARE

Wanted—An experienced foreman for our sensitive drill press department. Standard Arms Co., Wilmington, Del.

Wanted—An experienced draftsman on tool design for the manufacture of small interchangeable parts. Standard Arms Co., Wilmington, Del.

Wanted—A young man experienced on setting up and operating Brown & Sharpe and Cleveland automatic screw machines. Standard Arms Co., Wilmington, Del.

Wanted—An expert repair man who thoroughly understands the construction and repairing of standard makes of firearms; good wages and steady employment to the right man. Standard Arms Co., Wilmington, Del.

Wanted—Three or four strictly first-class toolmakers experienced on gage and model work; highest market price and steady employment will be guaranteed competent men in one of the finest firearms factories in the country. Standard Arms Co., Wilmington, Del.

ILLINOIS

Wanted—First-class mechanic, thoroughly familiar with automobile engine construction, as assistant on assembling floor. Apply Excelsior Motor Mfg. Co., 22d & Halsted Sts., Chicago.

Wanted—First-class mechanic, thoroughly familiar with automobile engine construction, as inspector on assembling floor. Apply Excelsior Motor Mfg. Co., 22d & Halsted Sts., Chicago.

Wanted—Toolroom foreman, first-class on jigs and general tools for economically and interchangeably producing goods similar to cash registers, typewriters and slot machines; old established concern; none but thoroughly experienced men of executive ability. Apply to Box 536, AMERICAN MACHINIST.

INDIANA

Wanted—Toolmakers, automatic screw machine operators, bevel gear operators for Bilgram and Gleason machines; also a man with capacity as foreman for automatic and hand screw machine department, first-class man for case-hardening department, one experienced in handling gears for automobile work; give age, experience and references. 423 Johnson Block, Muncie, Indiana.

Wanted—Drop forge diemakers and bulldozer form fitters; we are increasing our output and have recently enlarged and re-equipped our machine shop, installing the most modern tools; we can use a number of first-class men on the above work and offer permanent employment at good wages to competent men; give experience in detail and wages expected. Employment Agent, Oliver Chilled Plow Works, South Bend, Ind.

MASSACHUSETTS

Wanted—Manufacturer's agent already representing staple lines to handle a line of high-class machine tools. Box 520, AM. MA.

MICHIGAN

Wanted—Toolmakers and grinders, die sinkers and drop forge hammer men, machinists and automatic screw machine operators; A-1 men only. Buick Motor Co., Flint, Mich.

Drop forge superintendent who can show a successful record for at least five years can obtain position with large company in Michigan, who will pay good salary to the man who can produce results; the man must be able to design dies, plan equipment, direct die and forge room foreman and build up first-class organization. In reply give references, age and salary expected. Box 540, AMERICAN MACHINIST.

Wanted—One of the oldest and best established companies in the Middle West seek the services of a general foreman for their ma-

chine shop; about 350 are employed in the department, and building and equipment are thoroughly modern; the nature of the work varies from a line similar to automobiles and manufactured in large quantities, to a medium heavy plain class of railway equipment; none but high grade men apply, as the position is an important one and requires a man of broad experience. Box 415, AM. MACH.

NEW JERSEY

Wanted—First-class water meter general foreman accustomed to precision work; state terms and previous experience. Box 543, AMERICAN MACHINIST.

Wanted—Mechanical draftsman; man with experience on cranes and structural work, by concern near New York; state salary wanted. Box 534, AMERICAN MACHINIST.

Draftsman wanted by a Newark manufacturing company, for jigs, fixtures, die work and small parts; only first-class men need address Box 515, AMERICAN MACHINIST.

Wanted—First-class water meter engineer having had experience in designing and manufacturing; state requirements, age and previous experience. Box 542, AMER. MACH.

Wanted—Machinists; steady work for good milling, boring, lathe and floor hands; also tool and die makers; call in person if possible; cheap rents and pleasant surroundings. Ferracute Machine Company, Bridgeton, N. J. (40 miles south of Philadelphia).

NEW YORK

First-class draftsman or designer; prefer one with experience on presses, dies and sheet metal machinery. Box 546, AMER. MACH.

Wanted—First-class machinist to run Acme automatic screw machines; state experience in full and give references. Box 491, AM. M.

Wanted—Tool or die makers accustomed to very close and accurate work; first-class men only; good wages; steady position. Doehler Die Casting Co., Court & Ninth Streets, Brooklyn, N. Y.

All-around machinists, including lathe, drill, planer, milling machine and vise hands, can obtain steady employment by applying to Brooks Works of the American Locomotive Company, Dunkirk, N. Y.

First-class machinists and tool makers wanted; applicants must state wages desired and give previous experience in order to receive further consideration. Address Ingersoll-Rand Co., Painted Post, N. Y.

Wanted—Competent lathe, milling machine and vise hands; good wages and permanent employment for first-class mechanics who are temperate and industrious; references required. "Machine Tools," AMER. MACHINIST.

Wanted—Thirty machine shops in Rochetser, N. Y., want first-class machinists for steady positions; to efficient men wages $16.50 to $21 per week and 9 hours per day; open shop. Write P. O. Box 252, Rochester, N. Y.

Wanted—Toolmakers on model and experimental special automatic machine work; good pay and steady work to competent men; give age, experience and references. Apply The S. S. White Dental Mfg. Co., Princes Bay, N. Y.

Wanted—General foreman with thorough knowledge of manufacturing methods; must have wide experience in punch press, screw machine, milling machine work, etc., and be capable of handling men and work without friction; references required; state salary expected. Box 537, AMERICAN MACHINIST.

Wanted—We are constantly increasing our force and invite applications from the following: Machinists, lathe hands, screw machine hands, grinder hands, milling machine hands, motor assemblers, toolmakers, sheet metal die men; we run a nine-hour shop, have desirable surroundings, and offer steady position to desirable characters. Address Superintendent, Maxwell-Briscoe Motor Co., Tarrytown, N. Y.

OHIO

Lathe, boring mill, shaper and planer hands; first-class; increasing force. The Heisler Co., St. Marys, O.

Wanted—Draftsmen familiar with detail crane design; state wages desired. The Toledo Massillon Bridge Co., Toledo, Ohio.

Wanted—Foreman for die tool room; must be expert on dies for general line of sheet metal work. The Toledo Machine & Tool Co., Toledo, Ohio.

Wanted—Salesman to sell emery wheels in Ohio, Pennsylvania and New York; give age, experience, references and salary expected. Address "W. E. S." AMER. MACH.

Wanted—Expert in factory cost systems and general accounting by prominent manufacturer in Cleveland; give references and experience. Box 493, AMERICAN MACHINIST.

Wanted—First-class machinists, toolmakers die sinkers, lathe, planer, drill press, screw machine, boring and milling machine operators, wood patternmakers, brass molders, polishers, buffers, finishers, spinners, millwrights, hammermen and blacksmiths who are seeking positions or desirous of improving on those which they have, to register their names and addresses with the free Employment Department of the National Metal Trades Association. Address Commissioner's Office, 605 New England Bldg., Cleveland, O.

PENNSYLVANIA

Wanted—Draftsman, experienced in automobile work; give age, nationality, experience and salary expected. Box 544, AM. MA.

Wanted—Mechanical draftsman able to design and make complete details of special boring and turning mills and other machinery. Write fully, giving experience and wages expected. Box 463, AMERICAN MACHINIST.

Draftsman—Bright, ambitious young man, one capable of doing detail work on motors, transmissions, axles, and other automobile work; one accustomed to detailing and making finished shop drawings required; bright future. Please communicate by letter or call in person. Mack Bros. Motor Car Company, Allentown, Pa.

Cost estimator; a man thoroughly familiar with operation costs on light and medium heavy machinery and specialties; must be fully competent to estimate from blue prints or sample machines the cost of manufacturing; none but first-class experienced men need apply; give references. Lycoming Foundry & Machine Co., Williamsport, Penn.

Wanted—We have positions to offer from time to time for the following lists of first-class mechanics: Metal pattern makers; wood pattern makers; iron molders, bench; iron molders, floor; brass molders, bench; machinists; brass finishers, Fox monitor; brass finishers, turret lathe; toolmakers; work consists of brass and iron valves and fittings. In applying for any of the above positions state age, experience and wages. Address F. E. Johnson, Supt., The Kelly & Jones Co., Greensburg, Pa.

The Monotype School is maintained to train young men to meet the constant demand for operators of our type casting and composing machine; these operators do so well that we receive more applications for places than can be filled; these qualifications carry most weight: Common sense, automatic machinery experience, printing office experience, type foundry experience. Full particulars will be furnished to inquirers who furnish the same information about themselves, and mention this paper. Lanston Monotype Machine Co., Philadelphia.

## Situations Wanted

*Classification indicates present address of advertiser, nothing else.*

CANADA

Mechanical engineer, technical graduate, broad practical knowledge, 15 years' experience in saw mill and pulp mill engineering, desires position with first-class firm as chief engineer or sales engineer. Box 548, AM. MA.

CONNECTICUT

Position wanted as assistant superintendent or to take charge of high grade experimental work; 20 years' experience designing and building; typewriter and adding machine models, tools and special machinery, manufacturing and assembling; good inventor, expert on adding machine construction. Box 547, AMERICAN MACHINIST.

ILLINOIS

Experienced, practical and systematic superintendent on large and small machine work, intends making change. Box 514, AMERICAN MACHINIST.

MASSACHUSETTS

Office executive, young man capable of assuming full responsibility; specialist on cost work, production man and systematizing; good correspondent; at present and for several years employed by large manufacturing concern; A-1 references. Box 541, AM. MA.

Wanted—A situation as mechanical superintendent or works manager; I have executive ability and practical mechanical experience that will meet the most exacting requirements in all departments for the manufacture of any class of mechanical goods and machinery. Address Box 519, AMER. MACH.

NEW JERSEY

Draftsman, first class, well experienced, seeks position. Box 551, AMER. MACHINIST.

Position as machinery salesman or inspector, by young man with business and practical training. Box 527, AMER. MACHINIST.

Foreman or assistant superintendent with a wide experience in machine shops, in United States and foreign countries, seeking a position with some reliable firm. Box 549, AM. M.

Mechanical engineer and draftsman, 3 years' shop, 6 years' drafting room, and 2 years' experience as superintendent of factory, wishes steady employment; go anywhere. Box 550, AMERICAN MACHINIST.

NEW YORK

Designer, experienced on automatic and special machinery, capable of taking charge of work. Box 524, AMERICAN MACHINIST.

College graduate, mechanical draftsman, desires to change position; at present engaged with steel concern. Box 556, AM. MA.

First-class draftsman (26) desires change; technical graduate, experienced in gas engines; good jig designer. Box 517, AM. MA.

Position as superintendent or foreman by experienced man in light machine manufacturing tool and special machine designing. Box 545, AMERICAN MACHINIST.

Gas engine designer desires change; wide experience in design and construction of heavy duty engines; age 29; technical graduate. Box 552, AMERICAN MACHINIST.

Assistant superintendent; foreman; reliable, practical, executive, systematizer; age 34; manufacturing, die or tool work; New York City; environs. Box 553, AM. MACH.

Technical graduate, 27, over 5 years' experience designing, hoisting and elevating general and automatic machinery, wants responsible position. Box 555, AMER. MACHINIST.

General foreman, middle aged; newest ideas; now employed; engineering work, electrical and general machinery; A-1; hustler; can handle force with executive ability. Box 523, AMERICAN MACHINIST.

Superintendent of manufacturing company desires change; thorough executive, broad experience; can install modern methods and systems; references; not less than $3000 per year. "C. D.," AMERICAN MACHINIST.

Designer, graduate, 12 years' experience, adding machinery, typewriters, fixtures, automatic machinery, experimental design, inventive and practical, open for engagement. Address Box 554, AMERICAN MACHINIST.

Superintendent or general foreman wants position; 12 years' experience; first-class executive ability and organizer; well posted on modern methods; expert tool designer; references. Box 533, AMERICAN MACHINIST.

Superintendent or foreman desires position in Greater New York; practical, experienced, uptodate mechanic; resourceful, a hustler; executive ability, design labor saving tools and fixtures; gets results. Box 539, AM. MA.

Mechanical draftsman, also having varied experience general construction work, six years practical knowledge, neat, accurate on working drawings, can furnish best references, wishes position with reliable firm. Box 532, AMERICAN MACHINIST.

The services of the head of the mechanical department of a large technical school are available from June 15 until May 15; member of the American Society of Mechanical Engineers, graduate of Cornell University and ten years' practical experience in machine design, power plant installation and manufacturing. Address "G. L.," AMER. MACHINIST.

WISCONSIN

Foreman open for engagement; successful in increasing production and reducing costs of manufacturing; executive ability; expert jig designer, will go anywhere; references. Box 495, AMERICAN MACHINIST.

Position wanted as a superintendent or general shop foreman in a large machinery manufacturing plant; I am 35 years of age, strictly sober and understand modern shop methods; have had lots of experience in handling men for over 14 years; understand designing Corliss engines, air compressors, ice machinery and tool and die work; will be ready to take position June 1; can give very best of references. Box 496, AM. MA.

## FOR SALE

For Sale—42" Bullard boring mill in good condition, having been in service only three years; send us your bill for the above. Detroit Stoker Company, Detroit, Mich.

For Sale or Rent—Foundry, machine and woodworking shops with machinery in village of Albion, N. Y.; no foundry within 10 miles. Geo. H. Church, Bergen, N. Y.

For Sale—A complete Davis-Bournonville oxy-acetylene apparatus in first-class order; has been used about one year; can be seen at the Hartford Suspension Co., 150 Bay St., Jersey City, N. J.

For Sale—One Nash gas engine, 20 horsepower, two cylinder, for electric lighting, pumping or power; one Beaman & Smith horizontal boring mill; table 25 inches wide, 36 inches long; will bore 12 inches diameter, 24 inches long, and face 20 inches diameter; one 300 light J. B. Colt Co. acetylene gas apparatus. The above machines are in excellent condition, having been very little used. For further particulars and prices apply to Rider-Ericsson Engine Co., 35 Warren St., New York.